MANUAL OF OBJECT TEACHING

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OF

OBJECT-TEACHING

WITH

ILLUSTRATIVE LESSONS IN METHODS

AND

THE SCIENCE OF EDUCATION

BY

N. A. CALKINS

AUTHOR OF "PRIMARY OBJECT LESSONS" "PHONIC CHARTS"
AND "SCHOOL AND FAMILY CHARTS"

"*The art of teaching is no shallow affair, but one of the deepest mysteries of Nature*"
COMENIUS

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TO

THE TEACHERS OF NEW YORK CITY,

WHOSE INTEREST IN METHODS AND PRINCIPLES OF EDUCATION—MANIFESTED BY THEIR ATTENDANCE AT MY SATURDAY LECTURES DURING SUCCESSIVE YEARS, BY THEIR USE OF INSTRUCTION GIVEN, AND BY THEIR WORDS OF APPRECIATIVE COMMENDATION—FURNISHED MUCH ENCOURAGEMENT FOR EFFORTS IN THEIR BEHALF, AND IN BEHALF OF THE BETTER EDUCATION OF CHILDREN,

THIS NEW VOLUME ON TEACHERS' WORK IS

Respectfully Dedicated.

PREFACE.

KNOWING that which is needful to be learned is a great attainment. Knowing what should be taught, and how to teach it, is a high art. To secure this necessary attainment is the first duty of every teacher. To master the high art is like unto the first duty in its importance; it enhances the value of the attainment in knowledge, and insures success in the great work of education.

It is strangely curious that the doing of the same thing may be both easy and difficult—easy when done in the right way, difficult when done in the wrong way. Success attends the doing in the right way; failure is certain to follow the doing in the wrong way. This is eminently true of teaching. Therefore, to determine what is the proper way becomes a question of great moment to every earnest teacher; for on the correctness of this decision depends the results of the teaching and the welfare of the pupils.

A person may compare the results of one period of his work with those of another period, and thus note his own growth and progress in that work; but no person can measure himself by himself, alone, and thus determine his actual ability. No teacher can measure his own work by itself, and thus determine its true quality. To obtain accurate results of any kind of work, and ar-

rive at just conclusions as to its character, comparisons must be made under many conditions, and extended to a multitude of cases. So the teacher must compare his own methods of teaching with those that have been proven to be good by a long series of practical experiments—made under a great variety of conditions, and tested by the principles of education — before he can know with certainty that he has a standard of high value to guide him in the work of instruction.

Those teachers whose methods agree with the principles of education, and are confirmed by intelligent experience, stand upon a plane far above that occupied by the untrained and unskilled school-keeper, or that of one who remains an undecided experimenter in this important field; and the intelligent work, approved by such reliable authority, becomes certain in the character of its results, and positive in its value.

To know how to teach, so as to secure the best results of education, is the most common need in teachers. One of the chief purposes of this work is to furnish teachers with available means whereby they may ascertain what is the nature of the being to be taught, the true character of the work to be done in teaching, and how the important results aimed at may be attained with a good degree of certainty under all ordinary circumstances. Toward the accomplishment of this object, a variety of methods are described for teaching many subjects, thus endeavoring to point out those fitted for the differing conditions of the largest number of teachers.

There are many subjects concerning which teachers must seek information almost daily—information which they cannot be expected to have always at their tongue's end, as they do the multiplication table. To have the

means necessary for obtaining this, easily accessible at all times, is a great boon to the teacher. To supply this means, in part, and to point out other sources where the desired information may be found, are among the purposes of this work. Toward the accomplishment of this, facts upon several appropriate subjects have been gathered and arranged for the special convenience of teachers, thus saving much time that otherwise might be spent on encyclopædias, and other works of reference, even by those who have access to such books. It is not claimed that these collections of facts, concerning different subjects, are complete in relation to each topic, yet it is believed that teachers will find them specially useful in their work.

Permanent and uniform success in teaching must come through the use of those methods which are in accordance with the principles of education; therefore an intelligent understanding of those principles is necessary to the securing of desired results. From these statements the importance of attention to the science of education—of knowing what are the several powers of the mind, and the means for their development and proper cultivation—become readily apparent. By a careful study of this department of education, teachers may ascertain whether or not the means which they are using will accomplish the end in view in the acquisition of knowledge, and the proper training of mental power. Indeed, it is the duty of every teacher *to know how* to do his work, and also *to know why* he does it in one way rather than in another. An important purpose of this volume is to aid the teacher in learning *the how* and *the why*, in teaching, and thus help him onward in the better work of instruction, while it awakens, at the same time, a deeper interest in the

philosophy of education, and leads to a more thorough understanding of the important work to be accomplished.

The introduction of a series of questions for use in the examination of teachers on matters pertaining to object-teaching, to school management, to methods, and to general principles of education, is believed to be an important feature of this work; and one that will lead teachers, who carefully consider them, to a more intelligent understanding of the chief purposes of instruction, and enable them to accomplish better results in the training of those under their care.

It has not been one of the purposes here to present all the topics necessary to a complete course of instruction, even for a primary school; but rather, by means of methods illustrated with several objects, and by the principles of education, to set forth the chief results that should be secured through teaching; and to point out means within the reach of every teacher by which these desirable ends may be attained; and also to prepare them to devise and use equally good methods in teaching every subject.

It is one of the purposes in this book to increase the value of the work of instruction, and at the same time to lessen the amount of the teacher's labor, by showing how to train pupils to teach themselves. All real teaching is self-teaching. It is also an aim to render the work of learning more attractive to the pupils, and practical in its results, by the use of modes in harmony with natural methods of getting knowledge, thereby saving time, and making the work both of the learner and the teacher more easy of accomplishment.

Twenty years ago my work entitled "Primary Object Lessons" was published. The facts that it has now reach-

ed its fortieth edition, and also been republished in Spanish, thereby enabling those engaged in the work of education in both divisions of the Western hemisphere to become familiar with its plans of instruction, are indications that the methods for elementary training which it sets forth have been favorably received and widely introduced.

The new volume now presented to the public embraces the same general plan of instruction as did the former one; and it also extends over a broader field, including subjects for more advanced teaching, and introduces a greater variety of available means for developing the powers of pupils. This volume is further intended to supplement my first work on Object Lessons, thus presenting the subject in greater completeness by means of both books. It also specially aims to lead teachers to consider the principles of education by which true teaching is guided to valuable results.

It is earnestly hoped that this volume on the teacher's work will be found valuable for the variety of information which it supplies for the use of teachers—for the instruction it gives relative to methods of teaching, and the development of the mental, moral, and physical powers of pupils—for its statements pertaining to the science of education and the art of teaching; also that it may become an inspiration, unfolding to teachers a more thorough knowledge of their noble calling, and imbuing them with an enthusiasm that shall enkindle an ardent love of learning in all their pupils.

N. A. CALKINS.

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DESIGN OF OBJECT-TEACHING.

THE term *object-teaching* has been so frequently applied to modes of giving lessons widely differing in matter, manner, and aim, that its real import is often misapprehended. It seems to be necessary, therefore, to explain what constitutes *object-teaching*, that the reader may be prepared to understand the design of the succeeding lessons.

Object-teaching has for its purpose a thorough development of all the child's faculties, and their proper employment in the acquisition of knowledge. It is not a plan of fixed, unchangeable methods, but a system of training based upon and controlled by the fact that the beginning of real knowledge must come through the appropriate exercise of the senses. Its purpose is not the attainment of facts, nor the cultivation of language as an end, but the development, to vigorous and healthy action, of the child's powers of getting and using knowledge by the means both of obtaining and of using it. It furnishes exercises to produce the ability to learn, and methods to aid in learning. It does not signify the things about which something is taught, nor that which is taught about them, so much as it means the principles by which the teaching is performed, and the purpose and manner of the teaching.

It deals with things, and it considers subjects also. It attends to realities and their relations, rather than to ideals and their representations. It furnishes a means of attaining clear ideas of distant objects and events through those that are near and known.

Object-teaching prepares the learner's mind, by development begun through sense-perceptions, and continued by observation and reflection, to clearly understand the important facts concerning things and acts, and their relations to spoken and written language. It does not propose that the child shall gain all its knowledge from the process by which the human race was led through the wilderness of personal experiences to the attainment of the present sciences, but it does propose to lead the inexperienced learner into the midst of objects and influences that will awaken the several senses to activity, and thus increase his progress in knowledge. It proposes to guide the young learner till his enlarged experiences prepare him to extend his acquisitions through others' experiences as furnished by books, and also to confirm the facts thus gained by his own observations.

Once more, object-teaching implies,

First. The use of systematic exercises with objects, for the development of the power of gaining knowledge;

Second. A training in habits of getting knowledge from objects, models, pictures, and diagrams by careful observation — both of these ends being reached through the guided personal experiences of the learner;

Third. The teaching of pupils to avail themselves of facts discovered by others and recorded in books, and training them to verify those facts, so far as practicable, by personal examination.

For further explanation of the design of object-teaching I will describe the stages into which the work may be divided, and the purposes of each.

First Stage of Object-teaching.—The first stage of object-teaching has for its chief aim the development of the child's perceptive powers through proper exercise of the several senses. At this period it does not propose the teaching of objects nor of subjects, but rather a systematic plan of using objects as a means for developing the senses to that facility of activity which will enable the child to form habits of gaining knowledge by careful observation.

This stage of object-teaching should be commenced by the mother before the child is old enough to enter school; and during the first year or two the chief efforts should be directed to the supplying of suitable materials to induce the exercise of each of the senses, and, when necessary, stimulating the child to use these materials in such a way as to become familiar with their *easily perceived* properties and qualities—as colors, shapes, hardness, softness, sweetness, sourness, heaviness, lightness, etc.—devoting less attention to teaching the *names* of these properties than to training the pupils to receive them readily.

The want of knowledge which the child expresses by those familiar and oft-repeated questions, "What is it?" "What is it for?" "Why does it do so?" should be carefully heeded, and the child led to find answers to his own questions, as far as possible, through his personal experiences. The exercise of his powers which the child gains by that which he sees and does with the objects teaches him the most useful lessons during this stage—lessons which are more valuable than the words which he learns to say about them. It is through such lessons that the young learner develops his perceptive powers by the contact of his senses with the objects about him, and gains a real knowledge of them.

Kindergarten training belongs to this stage of object-teaching. And where children enter school without hav-

ing received any systematic training for the development of their senses, either through home training or by kindergarten instruction, this introductory stage of object-teaching should be employed during the first term of school attendance in the lowest primary class, as a means for preparing the young pupils for subsequent instruction.

The efforts toward teaching language during this stage should be limited chiefly to the names of objects and acts, and to the obvious properties which the pupils distinguish.

Second Stage of Object-teaching.—This stage properly belongs to the first years of the child's school-life, and its chief aim is to prepare the young pupils for receiving instruction in the elementary steps of those subjects which are included in the course for the first two years at school. *Objects may now be employed both as a means of development and as subjects of instruction; but the development and the instruction must be based upon the pupil's personal experiences.*

The first duty of the teacher, in the second stage of object-teaching, is to supply materials suitable for the exercise of the child's powers, and then to stimulate and guide in the proper exercise of those powers. The materials first provided for instruction at this time should consist of objects chiefly. Pictures may be used profitably during later exercises. The teacher must co-operate with and direct the pupil's own activity in the use of the materials for the child's development, but should do nothing to supersede the personal activity of the pupil. The child's education comes from that which he does himself. The teacher should endeavor to secure discipline of the pupil's mind through the formation of habits of ready and accurate observation.

When an *object* is the subject of a lesson, the pupils should be led to observe those obvious qualities and properties in which it resembles similar objects; also those by which it is chiefly distinguished from other objects, or which add most to its usefulness. The teacher should cause the instruction about the object to be intimately associated with the facts already learned by the pupils through their own observations.

When a *subject* or *topic* is the matter of the lesson, the pupils should be prepared for the instruction by first directing their attention to kindred facts already known, and their knowledge of these used to teach the unknown of the new subject.

During this stage attention should be given to teaching the children the use of simple language that will enable them to express the knowledge which they acquire concerning the objects or the subject-matters that constitute the lessons.

Third Stage of Object-teaching.—The acquisition of knowledge by means of objects, and the use of facts previously learned to aid in gaining knowledge of new subjects, become prominent aims of this system of instruction during the third stage of object-teaching. The number and kinds of objects, and the range of appropriate subjects, are now greatly increased. The principles which give shape to the plans of teaching during the first two stages now may be extended to a greater variety of subjects; and objects, pictures, diagrams, etc., be used to aid the pupils in obtaining clear and correct ideas pertaining to these different subjects.

In lessons upon objects, the pupils should be led to distinguish those qualities and properties which give special value to the object, and which chiefly render it suitable to those uses for which it is commonly employed.

If the lessons be on animals, the children may be led to observe the prominent peculiarities of some familiar animal—as a cat; such as the shape of its head, teeth, claws, feet, ears, eyes, nose; then these and its habits may be compared with others of the same family—as the lion, tiger, leopard, lynx, and panther in a menagerie, or by means of pictures, and the pupils thus taught their obvious family likenesses and characteristics.

If the subject be geography, the teacher may commence with the school-room—its shape, boundary, its location, and direction from familiar places in the vicinity; then direct attention to streams, ponds, islands, hills, valleys, and occupations that are known to the children, and from their knowledge of these teach them to understand lessons about similar objects and occupations in countries which they have not seen.

If the subject be arithmetic, counting, adding, and other operations with objects may be employed to give correct ideas before processes, definitions, or rules are taught. Thus the plan of instruction in this stage also places the knowledge of *things before words* in the order of teaching, and in the order of importance. It illustrates by objects, pictures, drawings, and examples, before presenting descriptions, definitions, or rules. It trains children in the manner best suited to the gaining of ideas from objects or from subjects, and gives them the proper language for expressing those ideas. It leads also to a classification and association of kindred ideas and facts. And during succeeding lessons special care is taken to associate the new facts with the knowledge previously learned concerning the same subject; also to extend and attach all knowledge, as far as practicable, to the affairs of daily life; and thus cause the school-lessons to become instruction on real things.

Object Lessons and Object-teaching.—Those processes of instruction which embrace the aims already described, and conform to the principles herein presented, and secure the results thus contemplated, may be called *object-teaching.* This system of using objects, and of treating subjects by its methods of teaching, develops the mental powers through a proper exercise of the appropriate senses, and leads to correct habits of gaining knowledge; therefore, it will be seen that it is chiefly the *manner and purpose of using objects*, as a means of development and instruction, which determines whether the plan of proceeding may be called object-teaching, or not.

An object lesson has for its matter an object, or some quality or property of an object, which is made the means of gaining ideas and developing certain perceptive powers. An object lesson is an individual or single lesson upon an object, given in a proper manner, for a definite purpose.

Object-teaching may have as the subject-matter of a lesson an object, or a topic, or subject of any branch of knowledge. It is a systematic plan for successive lessons, so conducted that knowledge is derived from and associated with objects and the learner's personal experiences to the greatest extent practicable. It may embrace a course of instruction including many topics, with each lesson founded upon the pupil's previous knowledge, while it prepares him for succeeding lessons. It employs objects and facts previously known as the means of illustrating the new lesson. It is a process for combined development and instruction in accordance with correct principles of education.

True object-teaching implies knowledge obtained by and through *the pupil's personal experiences under competent guidance.* The teacher guides the learner to the knowledge, but requires the pupil to gain it by his own

exertions. The teacher arranges the materials for the lesson, and brings the mind of the pupil into such contact with the materials that the activity of the learner's mind secures the desired knowledge.

How the Child Obtains Elements of Knowledge.—For the purpose of securing a clearer understanding of the basis of object-teaching, and its adaptation to the attainment of the important ends in education already mentioned, the reader's attention is here invited to the following consideration of the manner by which children gain ideas and acquire their earliest knowledge.

It is a well-known fact that the mind is endowed with power of acquiring ideas; that this power is early manifested through the several organs of sense; and that by this means the elements of our knowledge are obtained. Even the consciousness which we have of our own minds, and of the mind's power, becomes more complete and vivid as the knowledge of things around us becomes more definite and thorough. The amount of information which the mind may acquire, from all sources, depends to a greater or less extent upon the clearness of the ideas derived through the senses. It is, therefore, evident that material objects and sensible events should comprise a large part of the exercises for intellectual training during childhood.

It has been well said that "the knowledge which a child acquires by the exercise of its own senses penetrates the intellect more deeply and pervades it more completely than any other, for it is the impression which nature herself makes upon the mind by direct contact; while all other media of instruction are but representatives of nature, more or less imperfect."*

* *Manual of Human Culture*, by Garvey.

The natural development of mind begins with its activity through the organs of sense, and corresponds in its progress to the facility which it attains in acquiring ideas through the influence of external objects. If these chief gate-ways of knowledge be but partially opened, the elements of ideas must pass through them with difficulty, and often become distorted by the passage. But with these doors and windows to the mind wide open, the obstacles to learning are easily overcome, and the pupil's progress made rapid, as clearness of perception leads to completeness of knowledge.

The earliest exercises of the child's senses excite in its mind *a desire to know* something about what it sees, hears, feels, tastes, smells, etc. This desire for information, or curiosity, increases with the delight experienced by new accessions of knowledge, and induces a continual mental activity and restlessness during the child's waking hours.

It is also a provision of nature that, as soon as the infant mind has taken in such knowledge of an object as its limited capacity can readily receive without aid, the child no longer manifests any interest in or curiosity toward the object; and unless a skilful instructor assists him in gaining still further knowledge, and thus continuing the interest, the child soon turns to seek information from something new. But, even when thus aided, the amount of information which the undeveloped mind has power to grasp, or capacity to receive at one time from the same object, is very limited, to say nothing of the fatigue which might be experienced by efforts to attend to the same subject for a long time; hence the child must of necessity change his attention frequently from one subject or class of objects to another.

Nevertheless, after an interval during which the mind has been occupied with other things, the same object

will afford fresh interest by a repetition of the information given before, thus recalling the pleasure experienced during its first reception. These facts account for that fondness for variety, or love of novelty, or curiosity, as this trait is variously called, which is so prominent in children, and which may be made a valuable means of aiding the teacher in both the instruction and the management of the class.

The same principles apply to the mind in youth and in maturity, the results differing in quantity or degree. As the mind attains degrees of development which enable it to gain more knowledge from an object, and acquires habits of attention which give it the power of observing the same subject for a longer time, there is less necessity for frequent changes.

Some objects naturally secure the attention and interest of children longer than others, because of the variety of the information which may be received from them, and the greater number of senses and faculties which they excite to action. Objects that move, and those which the children can themselves cause to move, and to assume various positions and shapes, and those exercises in which the children have something to do, belong especially to this class. Now it is of great importance for parents and teachers to remember these facts during the early training of children.

In conformity with these provisions of nature, and their relation to the capacity of the infant mind, *the first lessons of instruction should be short and frequently alternate.* But as the mind becomes stronger from repeated exercises, the habits of continuous attention become fixed, and its capacity enlarged by development, the lessons may be increased in length, and the same subjects continued longer under investigation.

Habits are formed by repetitions of the same acts.

The pupil's habits of learning are chiefly formed by the modes of instruction employed by the teacher. To attain correct habits, the foundation must be laid in childhood. If a child be early trained in habits of accurate observation of the various properties of the common objects around him, he will have a permanent guarantee for the successful acquisition of knowledge during after-years.

We cannot add a *new power or faculty to the mind* by any method of teaching, nor change the natural mode of its development; but we *can* surround it with influences adapted to awaken its slumbering energies, and thus increase its power of action.

Importance of Attention to Methods of Teaching.—It is a well-known fact that proper exercise develops and strengthens our limbs. The mind is subject to the same laws of development, and requires suitable exercise to give it the power of vigorous action. *The manner of learning*, as well as the facts acquired, develops the mind, and disciplines its powers in habits that influence all its subsequent attainments in knowledge. It becomes, therefore, a matter of great moment what *methods of instruction* shall be employed in the processes of early education, since upon these must depend, to a great extent, the habits of learning that will influence all the future career of the pupil. Systematic object-teaching gives special attention to the *manner of learning* with a view to the formation of the best habits.

The principles of object-teaching require that children shall first *be trained to use their several senses with facility, and to observe with accuracy;* that they shall *be taught to compare objects, and classify like things and facts, and to describe intelligently* what they observe around them. These principles also require that children shall be taught the rudiments of each subject presented to them, during

the early stages of education, in accordance with the natural mode of gaining knowledge, before books relating to the subjects are placed in their hands; also that these elementary steps of instruction shall prepare the way for, and lead to an intelligent use of text-books. During the third stage of object-teaching the pupils should be encouraged to seek knowledge from books as well as from objects, and thus form correct habits of learning from this important source of knowledge.

Object-teaching takes heed of the *prominent characteristics of childhood*—the desire to use the respective senses in seeing, hearing, feeling, tasting, etc., and their limbs in doing. It leads children *to use their powers for perceiving, trains them to know from observing, and to accumulate knowledge by classifying like objects, facts, and experiences, and associating them with the things to which they chiefly relate.*

Children generally make great progress in the use of their senses, in the development of their faculties, in acquiring facts from surrounding objects, and in strengthening their physical powers, before they enter school. Object-teaching requires that due cognizance shall be taken of these facts, by ascertaining the extent of this progress, and then employing the appropriate means for continuing the pupil's advancement in knowledge in accordance with the same laws of nature which controlled the process of learning before the child came under the influence of school. For the accomplishment of these aims, suitable exercises are provided whereby the undeveloped powers of the pupils—their defects of hearing, seeing, speech, etc.—are as far removed as the nature of the case will allow. Thus it is the design of object-teaching, during all the stages of instruction, to consider first the real state of the mind's development, as a means of determining what steps should be taken in the methods

of teaching, and then to proceed in accordance with the needs of the case and the laws of mental growth.

Other Means than Common Studies needed for Training.—The common studies—reading, spelling, arithmetic, grammar, geography, and writing—do not supply all the needed opportunities for fixing the attention and continuing the interest of pupils; nor do these furnish the varied exercises for training the several senses of children in a manner that will lead to a complete development of the different faculties of the mind. Indeed, these subjects, as too commonly taught, do not lie within the range of the usual experiences of children; therefore they do not furnish the best materials for the first steps of instruction. For these reasons lessons on the shape, color, and qualities of objects, the prominent characteristics of animals and plants, and various other objects, are needed both to precede and supplement the means formerly used in elementary instruction. It is only when the conditions for instruction are favorable that pupils may be easily led to form those good habits of learning which will secure a proper mental development, and the power resulting from right discipline of mind. *A correct habit of learning is chief among the important ends to be secured by object-teaching.*

Means of Developing Language.—Object-teaching supplies the very best means for developing the language of children. The child first learns to use the *names of things*, then the *names of actions*, and afterward *names of kinds and qualities of things*, and words that tell when, where, and how actions take place.

His lessons on objects, of whatever kind, continually add to his vocabulary of words representing names; of words telling the qualities, properties, shapes, colors, and

uses of objects; of words representing various actions, and the manner and time of those actions. Besides, by true object-teaching he is led to see, to think about what he sees, and then to talk about it, or describe it to others. He is taught which are the best words to use, and how to employ them, both in spoken and written language. He is thus supplied with all the materials necessary for a full development and ready use of our language.

The matter of developing the language of the pupils, and training them to use it correctly and fluently, should constitute one of the aims of object-teaching throughout all the subjects of instruction, even though not mentioned in connection with each group of lessons.

To this end the mistakes made by the pupils should be noticed, and correct expressions taught them. *Language is best learned by its proper use, not by rules.*

Wherever the characteristics of childhood are carefully studied and clearly understood, the utility and importance of object-teaching, in the processes of elementary education, can no more be questioned than can the necessity and usefulness of the gardener's labor in preparing the soil for his plants, or that of the farmer in getting his fields ready for the various seeds which he hopes will spring up and produce the ripened grains and delicious fruits both as the result and the reward of his labors.

Whoever studiously observes the means by which the minds of children are naturally developed, and the manner of acquiring that which is most lasting in its substance, most enduring in its influence, and most practical in its usefulness, of all their educational attainments, cannot fail to acknowledge the important agency of object-teaching, when directed by a skilful teacher, in laying the best possible foundation and supplying the best conditions of success in elementary education.

Object-teaching.—What object-teaching is has been described so exceedingly well by Professor S. S. Greene, of Brown University, that I take the liberty of repeating his language in this connection.*

"Object-teaching is that which takes into account the whole realm of nature and art, so far as the child has examined it, and assumes as known only what the child knows—not what the teacher knows—and works from the well known to the obscurely known, and so onward and upward till the learner can enter the fields of science or of abstract thought. It is that which develops the abstract from the concrete, which develops the *idea*, then gives the *term*. It is that which appeals to the intelligence of the child through the senses until clear and vivid conceptions are formed, and then uses these conceptions as something *real* and *vital*. It is that which follows Nature's order—the thing, the conception, the word; so that when this order is reversed—the word, the conception, the thing—the chain of connection shall not be broken; the word shall instantly occasion the conception, and the conception shall be accompanied with the firm conviction of a corresponding reality. It is that which insists upon something besides mere empty, verbal expressions in every school exercise; in other words, it insists upon expression and thought in place of expression and no thought. It is that which cultivates expression as an answer to an inward pressing want, rather than by a fanciful collection of pretty phrases culled from different authors. It is that which makes the school a place where the child comes in contact with *realities*, just such as appeal to his common sense when he roams at pleasure in the fields. It is that which relieves the child's school task by making it *intelligible* and possible. It bids him examine for himself, discriminate for himself, and express for himself; while the teacher stands by to give hints and suggestions, not to relieve the labor. In short, it is that which addresses itself directly to the eye, external or

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* From "A Report on *Object-teaching*" made before the *National Teachers' Association*, 1865.

internal; which summons to its aid things present or things absent, things past or things to come, and bids them yield the lessons which they infold; which deals with actual existence, and not with empty dreams."

Its Effects.—"It should be introduced in some way everywhere. It will aid any teacher in correcting dogmatic tendencies, by enlivening his lessons, and giving zest to his instructions. He will draw from the heavens above, and from the earth beneath, or from the waters under the earth, from the world without, and from the world within. He will not measure the instruction by pages, nor the progress by fluency of utterance. He will dwell in living thought, surrounded by living thinkers. Thoughtful himself, he will be thought-stirring in all his teaching. In fact, his very presence, with his thought-inspiring methods, gives tone to his whole school. * * * Object-teaching has a direct influence upon the teacher himself. It cannot be pursued, even tolerably well, without making it manifest to any one that the great object of teaching is to deal with *ideas* rather than to crowd the memory with words. He who can give an object lesson well is capable of giving any lesson well, because he has learned that it is the *reality*, and not the expression of it, that is the chief object to be gained. He who makes it his first, second, and last aim to teach *realities* will soon discover two essential conditions: he must know the present capacity and attainments of the child, and then *what* realities are suited to them.

"If it were not for one fact, our primary schools would have cabinets of natural objects as varied as those that fill the halls of our highest institutions, and that is the simple fact that *children can remember words, as words, without associating them with any idea whatever.* They can use words which mean much, while to them they mean nothing. They can repeat them fluently, and use them as though they really meant something to themselves, by imitation of the teacher's voice. They can see that the teacher accepts them as though all was right. Here is a double evil: the teacher is a stranger to the child's real condition, and the child supposes he is actually learning something.

"One reason why many oppose object-teaching is the fact

that they cannot readily free themselves from the impression that their knowledge of the subjects to be taught is somehow necessarily connected with the language of the text-book. They have never tried to disengage it from the particular forms into which some author has moulded it. They use technical terms, and often the worst of technical terms, because they know no other. There is an almost servile dependence upon the use of certain terms; and if the whole truth were known, it might appear that the idea is not sufficiently mastered to disengage it from the term. How can such a teacher do otherwise than cling to his authority?

"The very essence of teaching lies in a living apprehension of the subject itself; such an apprehension as will enable the teacher to adapt his instruction to the child's real wants; which is just what a text-book cannot do. *Teach realities* is the true teacher's motto. To this he commits himself; nay, crosses the river and burns the bridge. He is ashamed of his teaching if it is anything short of this. Hence his ingenuity, his aptness, his versatility, his varied resorts in an emergency. He can teach with a text-book or without it. A text-book in his hand becomes *alive*."*

The Range of Object-teaching.—"It draws its materials from all branches of knowledge, dealing with things which can interest the child or exercise his mind. Thus it is Natural History for children; for it directs their attention to animals of all classes, domestic and others, their qualities, habits, uses,—to trees, and plants, and flowers,—to the metals, and other minerals, which are in constant use.

"It is Physical Science for children; for it leads them to observe the phenomena of nature, the sun, moon, and stars, and the seasons, with the light and heat which mark the changes of weather, with clouds, rain, dew, snow, and the properties of the bodies which form the mass of matter around us.

"It is Domestic Economy for children; for it exhibits to them the things and processes daily used in their homes, and the way to use them rightly.

"It is Industrial and Social economy for children; for it leads

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* Greene.

them to observe the various trades, and processes in different art-occupations, and the arrangements as to the division of labor which society has sanctioned for carrying these on in harmony and mutual dependence.

"It is Physiology for children; for it causes them to learn from their own bodies the uses of the various members for physical and mental ends, and tells the way to use them best to avoid their abuse.

"It is the Science of Common Things for children; for it disregards nothing which can come under their notice in their contact with the world around them, and in their intercourse with their fellows or their superiors."*

"Object Lessons should be extended to a range of things far wider than now. They should include those of the fields and the hedges, the quarry and the sea-shore. They should not cease with early childhood, but should be so kept up during youth as insensibly to merge into the investigations of the naturalist and the man of science.

"Having gained due familiarity with the simpler properties of inorganic objects, the child should by the same process be led on to a like exhaustive examination of the things it picks up in its daily walks—the less complex facts they present being alone noticed at first. In plants, the color, number, and forms of the petals, and shapes of the stalks and leaves. In insects, the number of the wings, legs, antennæ, and their colors. As these become fully appreciated and invariably observed, further facts may be successively introduced. Here we have but to follow Nature's leadings. Where can be seen an intenser delight than that of children picking up new flowers, and watching new insects, or hoarding pebbles and shells?

"The consistent follower of Bacon, the 'servant and interpreter of Nature,' will see that we ought modestly to adopt the course of culture thus indicated."†

* James Currie, Principal of the Church of Scotland Training College.
† Herbert Spencer, in his *Education*.

PLACE, DIRECTION, AND DISTANCE.

INTRODUCTORY TO GEOGRAPHY.

IDEAS of *location* and *direction* are necessary to an understanding of even the most elementary lessons in Geography. Before children can comprehend the relative location of countries in different parts of the world, they must have observed the position of objects around them, and the direction of the same from each other and from themselves. Some ideas of such things are usually acquired by children, even when left to their own experience; but their knowledge of location and direction will remain too indefinite to be of much utility in learning geography without special training on this matter in the school-room. It is for this reason that the following *Lessons on Place and Direction* have been introduced, with a view to leading children to notice carefully the objects and scenery around the school and home, and insure the necessary preparation for elementary steps in Geography.

These preparatory lessons will differ as widely as the locations of the schools and the homes and the objects and scenery surrounding them differ, and therefore they must always be given orally. Not only must they be given without text-books, but they must be made up from actual observations and experience of the pupils.

The following lessons are intended only to explain the manner of conducting this oral training, and not as something to be taught to the pupils.

TO DEVELOP IDEAS OF PLACE.

FIRST SERIES OF EXERCISES.

First Exercise.—Teach the children to distinguish the *right* and *left* hands; *right* and *left* arms, elbows, shoulders, ears, eyes, cheeks, feet, and various objects to the *right* and to the *left* of the pupils. In doing this the teacher may ask:

Which is your *right* hand? Which is your *left* hand? Hold your book in your *right* hand. Take your book in your *left* hand. Who sits at your right side? Who sits at your left side? What things can you see on the left side of the room? What things can you see on the right side of the room? Stand on your right foot. Rest on your left foot.

When the children can readily distinguish *right* and *left* positions, they may be led to understand the terms *front*, *back*, *rear*, *before*, *behind*, *above*, *over*, *below*, *under*, *by the side of*, etc. This can be accomplished by holding a book or other object *above* the table, *below* it, *by the side* of it, to the *left* of it, *before* it, etc., and requesting the pupils to tell, in each instance, *where* the object is held.

Second Exercise.—Place three objects on a table in front of the class—one on each end, and one in the middle of the table; as a cup, a book, and a slate. Then require the pupils to observe and tell where each object is located, thus:

The cup is in the *middle* of the table. The book is on the *right-hand* end. The slate is on the *left-hand* end of the table.

When several of the pupils have described the position of the objects, each may be changed to another place, and the pupils requested to describe the new location. Afterward all the objects may be removed, and different pupils called upon to place

them in their former positions. Then they may be required to place them as directed, thus:

Place the cup on the nearest right-hand corner. Place the book on the farthest left-hand corner, etc.

Third Exercise.—Place four objects on the table, and request different pupils to describe the position of each, as in the last exercise.

Remove the objects, and then let the pupils place them in the positions which they occupied when described.

Afterward let pupils go to the table, singly as called upon, and each place an object in a position as described by the teacher.

Continue these exercises, as before, with five objects.

During the preceding exercises the several pupils should be allowed to take an active part in each until they have become sufficiently familiar with position, or *place*, to be able to distinguish the position of several objects, and to replace them after they have been removed.

Representing Position.—When the pupils are able to describe the position of objects, and to place them in position from descriptions, and to replace them from memory, they may be taught to *represent* their positions on the blackboard and on slates.

Having placed three objects on the table so that one stands in the centre, one in the front right-hand corner, one in the back left-hand corner—the teacher may show the pupils how to represent the surface of the table on the blackboard, and the position of each object on it, somewhat in the following manner:

I wish to draw lines on the blackboard to represent the sides and ends of this table or its *boundaries*, so that you will see there the shape of its surface; also to place marks to show the position of each object on the table. I wish to represent the position of the table and these objects, just as they would appear to you were I to take up the top of the table and place it against the blackboard, as I now take up this slate and place it against the blackboard.

Teacher. Now please tell me where I shall draw the line to represent the back edge of the table.

Pupils. Across the blackboard, above the middle.

Teacher. Where shall I draw the line to represent the front edge of the table ?

Pupils. Across the blackboard, below the middle.

T. Where shall I draw the line to represent the left end of the table ?

P. From the upper to the lower line, near the left side of the blackboard.

T. Where shall I draw the line to represent the right end of the table ?

P. From the upper to the lower line, near the right side of the blackboard.

T. Now we have the shape of the surface of the table represented, who can tell me where to make marks to show the position of the book on the table ?

P. Make them at the right side, near the lower corner.

T. Where shall I make marks to show the position of this cube on the table ?

P. Make a small square in the centre of the drawing on the blackboard.

T. Where shall I make marks to show the position of the bell on the table ?

P. Make a circle at the left side, near the upper corner.

The teacher will please notice that in each case the pupils are called to observe and describe, and thus direct what the teacher shall do. The teacher must see that the pupils do their own part of the observing, thinking, and describing, while he represents what they describe, and also requires them to determine whether or not the representation is correct.

After two or three representations of the surface of the table, with the position of three or more objects upon it, have thus been drawn on the blackboard, the pupils may make a *copy* of the representation upon their slates. They may also be called to locate the objects in the drawing upon the blackboard, and to represent their positions on the table.

These exercises will prepare the pupils for understanding the use of maps when instruction in elementary geography is commenced.

SECOND SERIES OF EXERCISES.

First Exercise.—Lead the pupils to describe the location of several objects in the school-room, somewhat after this manner:

The door is in the left-hand corner of the room.
The windows are on the right-hand side of the room.
The stove is in the centre of the room.
The teacher's desk is in the front part of the room.
The chair is back of the teacher's desk.
The closet is at the right of the desk.

The teacher may also ask questions similar to the following:

Where is the ceiling of this room? Where is the blackboard? What room is nearest this? What room on the left of this? What room back of this? How many class-rooms are there on this floor?

Represent the shape of this room on the blackboard, and the position of the prominent objects in the room that occupy space on the floor. Let pupils copy the representation on their slates.

Second Exercise.—Request the pupils to draw on their slates the boundaries of the class-room, and represent the position of the objects in it from their own observation.

Third Exercise.—Let the pupils draw the outline shape of one floor of the school building, and represent the location of the several rooms on the floor.

Other Exercises.—Talk with the pupils about the different kinds of rooms at home, and encourage them to make drawings of single rooms, also of several rooms of a house, as kitchen, dining-room, pantry, hall, parlor, bedroom, etc.

Encourage the pupils to represent the location of objects about the school-house, as streets, yards, etc.

TO DEVELOP IDEAS OF DIRECTION.

First Exercise—Simple Direction.—The first lesson may be a simple one of direction alone. Request the children to point toward objects in the school-room; then toward the streets near, as each is named by the teacher; also toward the nearest house, store, church, railroad, river, pond, canal, mountain, hill, village, etc.

Of course the location of the school, and the objects surrounding it, must determine what the teacher will ask the pupils to point at.

Second Exercise — To Show the Necessity of Fixed Points of Direction.—For the accomplishment of this purpose the teacher might say to the pupils: "When I asked you about the position of different objects in this room, you said that one of them was located at your right hand, another one at your left hand, and so on. Now observe where I stand, and tell me which way I must walk to go to the door."

"You must go toward the right."

After turning half-way around, the teacher says, "Now must I go to the right to find the door?"

"No, the door is behind you."

Turning half around again, the teacher asks, "Must I go to the right, now, to find the door?"

"No, the door is in front of you."

"Thus you see that you must know where and how the person stands before you can direct him, by the use of the terms right or left, which way he must go to find any given object. Suppose a person should inquire the way to the post-office, could you inform him by saying 'Go toward the right,' if you did not

see whether his right hand was on the side toward the post-office?

"You perceive that it would be very difficult to direct people where distant objects and places may be found without having some fixed points of direction which all understand. There are such fixed points commonly known, and these I propose to teach you in the next lesson."

Third Exercise—Points of Compass.—You may point in the direction in which you see the sun at noon. Very well. At noon the sun is in the *south.* Now point toward the south.

Point in the direction in which you see the sun in the morning. We say the sun *rises* in the morning, and *sets* in the evening. Now point to the place where the sun *rises.* Now point to the place where the sun *sets.*

The place where the sun rises is called the *east.* You may point toward the east.

The place where the sun sets is called the *west.* You may point toward the west.

What can you see in this room that is *east* of you?

What can you see that is *west* of you?

John, you may walk in this room toward the east.

James, you may walk toward the *west.*

My bedroom has windows on one side of it. In the morning, when the sun rises, it shines in at my windows. On which side of the house is my bedroom? On which side of my room are the windows?

Does the sun shine into your bedroom in the morning?

Through which window in the school-room will the sun shine in the morning? Through which in the afternoon?

As I was walking the other day, I saw the sun before me, appearing like a very large red ball, sinking behind the hills. In what direction must I have been walking?

At the close of the lesson the children may repeat:

The place where the sun rises is called the east. The place where the sun sets is called the west. The place where we see the sun at noon is called south.

Fourth Exercise—Points of Compass.—You may point toward the *east.* Point toward the *west.* You may now point in the direction in which you see the sun at noon. What

is the place called where the sun is seen at noon? You may point toward the *south.*

The class may stand with backs toward the south, and right hands toward the east. Now the direction in front of you is called the *north.* You may point toward the north.

Point toward the west with your left hand.

Turn your face toward the *south.* Now point toward the east with your left hand, and toward the west with your right hand.

Once more stand with your right hand toward the east and your left hand toward the west. The point before you is called ——,* and the point behind you is called the ——.* The point at your right hand is ——.* The point at your left hand is ——.*

Four pupils may now be called upon to walk, in the school-room, in the direction of the four points of compass. Let each pupil be required to tell, before returning to his seat, in what direction he walked, also in what direction he must go to return to his seat.

The class may stand facing the north. Now point in the direction between *north* and *east.* The point between north and east is called *north-east.*

Now point in the direction between *north* and *west.* The point between north and west is called *north-west.*

The class may face toward the *south.* Now point in the direction between *south* and *east.* The point between south and east is called *south-east.* Point toward the south-east.

Point in the direction between south and west. The point between south and west is called *south-west.* Point toward the south-west.

The class may now point as I name the direction:—south; south-west; south-east; east; north; north-east; north-west; west; south-west; north-east; south-east; north; south; etc.

When the members of the entire class are thus called to point simultaneously, it is necessary to train them to be self-reliant, and to point without waiting to see how their class-mates do. To secure this independent action of each pupil let the teacher point at the same time in a different direction from the one given to the class, thus:

Teacher says, "Point to the east;" but at the same time the teacher points toward the south. Teacher says, "Point toward the

* Let the children supply the ellipsis.

north," but points toward the west. Teacher says, "Point toward the south-east," but points toward the south-west.

By this means the children soon learn to point toward the direction *named*, regardless of the way in which others point.

This plan will materially aid in training the pupils *to know* all the points of the compass with certainty, and also is suitable for rapidly reviewing large classes in this subject.

"Boxing the Compass."—Beside the eight points of compass, already named, there are eight others, making sixteen altogether. All of these are used by sailors. A sailor is said to be able to "Box the Compass" when he can name these sixteen points in their order, thus:

North, north-north-east, north-east, east-north-east, east, east-south-east, south-east, south-south-east, south, south-south-west, south-west, west-south-west, west, west-north-west, north-west, north-north-west.

Fifth Exercise.—When the pupils have learned to point out and name each of the eight directions commonly known as "the points of compass," let them be required to apply this knowledge in stating the directions of objects in the vicinity of the school.

Let them tell what direction different members of the class must take in coming to school, also what directions must be taken by them in going home.

Suppose you were walking toward the north in the morning, over which shoulder would you look for the sun? Which way would you look for the sun if walking north in the afternoon? Suppose you were walking toward the sun at noon, in what direction would you be going?

Does a street cross the one which passes by the school-room? In what direction does it run? Which way from us is that street? Do any of you live on it? If you were going home, in what directions would you go?

TO DEVELOP IDEAS OF DISTANCE.

In the natural modes of learning, children take notice of distance as well as of direction. This, therefore, becomes an important item in the elementary steps of instruction preparatory to lessons in geography. Inasmuch as the subjects of "Size," "Length," "Measure," "Distance," etc., have been presented in "Primary Object Lessons" [on pages 261–281], the teacher will do well to examine what is said there relative to the more elementary steps in the presentation of these subjects, and especially the suggestions pertaining to "Distance" [on page 275].

In addition to the lessons there presented, it is also desirable that the teacher should give a few exercises which will cause the pupils to associate ideas of direction and distance as their attention is given to familiar objects, places, etc., in the vicinity of the school-house, during these lessons introductory to geography.

First Exercise—Naming Relative Distances.—Request the pupils to name two streets running the same way, and tell which is more distant. Let them name the pupils that live nearest to the school in the same direction from it, also those that live most distant. Let them name streams, hills, ponds, orchards, fields, etc., that are near, and those that are distant. Let them also name objects, buildings, or places that are in different directions from the school, and tell which are nearer and which more distant. Let them mention places that are about half a mile distant, also those that are a mile distant, etc.

Representing Relative Distances.—The teacher may now represent on the blackboard the direction and relative distances of several of the objects, places, etc., named, and then request the pupils to copy these on their slates. Afterward the

pupils may be requested to represent on their slates the direction and relative distances of other places, as the teacher names them.

The pupils may represent the location of the school-room near the centre of their slates; then draw lines to represent the streets that pass the school.

Direct the pupils to write *North* at the top of the slate, *South* at the bottom, *East* at the right-hand side, *West* at the left-hand side. Then request them to represent the objects, places, etc., that are *north* of the school, in their relative positions toward the top of the slate; then the places that are *south* of the school toward the bottom of the slate; and those *east* of the school toward the right-hand side; and those *west* of the school toward the left-hand side.

Similar exercises may be continued, as the condition and progress of the class seem to demand. These will be interesting from the fact that they furnish the children with something *to do*, and will aid in preparing them to understand the representations by maps.

Such lessons may be extended so as to embrace all prominent objects and places *within the personal observation of the pupils;* as churches, school-houses, villages, railroad, depot, river, manufactory, lake, mountain, mine, etc., even though several miles may be included in the distances.

TO DEVELOP IDEAS OF BOUNDARIES AND MAPS.

Teacher. I will now try to make a drawing or map of this room on the blackboard, and I wish you to tell me where to place lines to represent the different parts of it. First I will tell you some important facts which must be remembered when drawing a map of any place:

The marks representing the north part, side, or end of the object must be placed at the top of the blackboard or slate, and those representing the south part at the bottom of the board; those representing the east at the right-hand side; those representing the west at the left-hand side.

I will write the words *North*, *South*, *East*, *West*, on the top, bottom, and sides of the blackboard to help you in remembering what I have just told you.

Now where shall I draw a line to represent the north end of this room?

Pupils. Near the top of the blackboard. [The teacher then draws a horizontal line near the top of the blackboard.]

T. Where must I make a line to represent the south end of this room?

P. Near the bottom of the blackboard. [The teacher draws a line in the proper position.]

T. Point toward the east side of the room. Where shall I draw a line to represent that side?

P. On the right-hand side of the blackboard. [The teacher draws a vertical line on the right-hand side, so as to connect the two horizontal lines previously made.]

T. Point toward the west side of this room. Where shall I draw a line to represent that side?

P. On the left-hand side of the blackboard. [The teacher makes the line in its proper position.]

T. What shape do these four lines form?

P. An oblong, or parallelogram.

T. Now observe and tell me in which direction this room is longer. Does the drawing on the blackboard represent the room longer from north to south than from east to west? Now take your slates and copy the drawing, which I made to represent this room, on your slates.

Where did you make the line to represent the north end of the room? On what part of your slate did you draw the line to represent the east side of the room?

Now tell me what part of the room these four lines represent. Have we drawn anything to show where the door and windows are? Look at the door and then tell me in which part of the room it is.

Pupils. The door is in the north end of the room, near the west side.

Teacher. Then where shall I make marks to show the position of the door?

Look at the windows and tell me where they are. Where shall I make marks to show the position of the windows in this room?

We now have a drawing of the walls of this room, and the places for the door and windows marked. Now you may place marks in the drawings on your slates to show where the door and windows are.

Next we will make marks to show where my desk stands; then some for the stove; then some to represent the places for your seats.

Thus proceed until the drawing on the blackboard represents the positions of the principal objects in the room, and then require the pupils to copy the same on their slates.

It might be well to draw an outline of the school-room on the floor with chalk, then to select objects to represent the different articles of furniture, and request the pupils to place them in their relative positions within this drawing.

Boundaries.—*Teacher.* What parts of the room do the lines which I drew on the blackboard to show the shape of this room represent?

Pupils. The walls of the room.

T. How many walls has this room? Then this room has a wall on each of its four sides. These walls are the *boundaries* of the room; they fix its size. How many walls bound this room? How did I represent these walls, or boundaries, on the blackboard?

P. By four lines.

T. You say that the walls bound a room; now if you should see a yard with a fence on each of its sides, what would you say bounds the yard?

P. The fence.

T. Yes, the fences around yards, or the fences or stone walls

around fields bound the yards or fields. In the city a square, or block, is bounded by streets. So if you wish to make a map or drawing of a field, you must draw lines to represent its fences; if you wish to make a map of a block or square in the city, you must draw lines to represent the streets that surround it.

Play-grounds.—For the next lesson the teacher may show the pupils, as before, how to draw a plan or map of the play-grounds, or school-yard. The teacher may talk with the pupils, and question them somewhat as follows, but of course adapting the conversation to the circumstances, objects, etc., which surround the school:

You have learned about the school-room, and how to make a drawing of it on your slates; now we will make a drawing of the play-ground and of the street. Which way from the school-room is the play-ground? Which way is the street? Where shall I draw the line to represent the north end of the play-ground? Where the line for the south end?

Proceed in a similar manner with all the lines for the boundaries; then locate the objects of the play-ground, as the swing, the place for ball-playing, etc.

Where is the street? "In front of the school-room." In what direction does it extend? "North and south," or "east and west," as the case may be. Do any of you live on this street? Which way is your home from the school-room? Which one of you, who does not live on this street, goes along it on his way home from school?

Now let us draw this street on the board. You said this street was in front of the school-room; now will you tell me which way the front is? "West." Then the street passes along the west side of the school-room. In what directions did you tell me it extended? If it extends north and south, how must I place the lines on the board to represent it? "You must draw them from the top to the bottom." Now draw them on your slates.

Does any street cross the one which passes by the school-room? In what direction does that run? Which way from us is that street? Do any of you live on it? If you were going home, in what direction would you go? How shall I represent it on the board?

Similar questions may be asked about all the principal streets in the vicinity, and each one drawn; and while doing this, the children should be led to observe "relative distances."

When the pupils become able to make good representations of the school-room and play-grounds, as already described, they may be taught to represent in a similar manner the streets, buildings, etc., situated near the school; or, if the school be in the country, the pupils may represent the boundaries of the fields in the vicinity.

Scale of a Map.—To give the pupils some idea of a "scale of maps," the teacher may draw two maps of the school-room on the blackboard—one quite small, and the other about four times longer and wider; then request the pupils to observe and tell how they differ. Care should be taken to have the pupils notice that the two drawings are alike in shape, and that they differ in *size* only.

One pupil may take a foot-rule and measure the blackboard, to find its length and its width. One pupil may measure one side of this class-room, and another one may measure one end of it.

"The blackboard is six feet long and three feet wide."

"This room is twenty-four feet long."

"It is eighteen feet wide."

Draw Class-room by Scale.—Very well; now we will make a drawing of this room on the blackboard. Let us make the length of it twenty-four inches, and the width eighteen inches; then each inch of the drawing will represent one foot of the room.

Which end of the room did you measure? "The north end." How many feet is it? "Eighteen feet." How many inches long must I draw the line to represent this end? "Eighteen inches long."

Where must I place the line to represent the north boundary of any object? "At the top of the board."

Which side did you measure? "The east side." Then where must I draw the line on the board to represent the boundary on the east side? "At the right side of the board, from the end of the line that represents the north end, downward."

Where must I draw a line to represent the boundary of the west side of the room? "At the left side of the board, from the end of the line that represents the north end."

How long is the south end of this room? "Eighteen feet."

How long and where must I draw a line to represent this south boundary? "Draw a line eighteen inches long, so that it will unite the lower ends of the lines drawn at the sides of the blackboard."

Now these four lines represent the sides and ends of this room. Each inch of the lines represents one foot of the room.

Let us proceed to represent the position of the door. How can we determine where to place the marks that show this place? "Measure and find how many feet the door is from the nearest corner."

"It is on the east side, five feet from the north-east corner; and the door is about three feet wide."

Then place your marks to show the position of the door three inches apart, and five inches from the upper corner on the right-hand side.

In a similar manner the teacher may require the pupils to determine where to place marks to represent the position of the desk, stove, wardrobe, and other objects in the class-room. They may copy the drawing of the class-room on their slates, observing the correct proportions between the length and width.

Draw Play-ground by Scale.—Two or three other lessons may be given for illustrating the *scale of maps.* Pupils might take a yardstick and find how many yards long and wide the play-ground is; then draw the form of the play-ground on the blackboard, making the boundary lines *one inch for each yard.*

Draw the Vicinity of the School.—Draw the block on which the school is located; or draw the vicinity of the school, to the extent of twenty or thirty rods, and let one inch represent a rod.

Find Scale of a Map.—Take a good map of the village or city in which the school is located, and teach the children how to find the scale upon which it is drawn. Then let them find the location of familiar places on the map, and by use of the scale of the map determine how far one place is from another. In the country a good county or town map would be very valuable for teaching the use of maps, and how the places are represented on them.

GEOGRAPHY.

"Knowledge of the nearest things should be acquired first, then that of those farther and farther off."—COMENIUS.

A KNOWLEDGE of geography must commence with things about the child's home, and proceed along the line of his personal experiences to objects and places more distant. The ideas thus gained within the sphere of the child's walks, rides, and journeys constitute the known by means of which he can acquire a knowledge of more distant places and countries. In this manner the young learner becomes familiar with the meaning of many terms used in geography—as brook, creek, river, spring, lake, pond, shore, island, hill, mountain, valley, plain, village, city, railroad, etc.—before he is required to learn the definitions of these forms of land and water.

But the limit of the available experiences of the child, through his observations of the different features of land and water, will be reached within a few months from the time that this instruction in the elements of geography begins. Then the period will arrive when geography must be taken up with a description of the earth as a whole, and continued from the shape of the earth as a globe to its surface of land and water; its continents and oceans; its islands, plains, and mountains; its seas, lakes, and rivers; its countries, peoples, animals, and productions. Here, again, the child's acquaintance with various objects, animals, productions, and people from different nations should be employed for enabling the young learner to realize that the distant countries are just as

real as the most familiar places in the vicinity of his own home.

Geography is the most comprehensive of all the branches of school instruction, and may be made the most interesting of studies if properly presented; but it will afford very little interest or profit to the pupil so long as the method of teaching it requires little else than the memorizing of the names of rivers, lakes, capes, islands, mountains, isthmuses, straits, boundaries, capitals, chief towns, etc.

This study leads the pupil to the consideration of an abundance of attractive objects in nature and art; the diversities of soil, climate, and productions of the earth; the varieties of animals, with their many interesting habits; the different races and nations, with their varied customs, manners, modes of travel, occupations, manufactures, and the records of their deeds of valor, and wonderful discoveries in the sciences. All of these may be made living realities to the young student of geography, by the proper use of the experiences of the learner, through the exercise of the imagination, a faculty which is exceedingly active in childhood, and of great service in the processes of education.

In the succeeding pages devoted to this subject I shall endeavor to illustrate methods by which lessons in elementary geography may be given successfully; how the teacher may proceed when taking up lessons upon the earth as a whole, to prepare the learner for gaining useful knowledge of the world through the study of books.

FIRST LESSONS IN ELEMENTARY GEOGRAPHY.

Where to Begin.—Let the first lessons in elementary geography begin with those features of land and water with which the children are already most familiar. Find out which features they know by a conversational exercise; then proceed by means of the known to give them ideas of similar things not so well known. Thus it will be seen that for children residing in different places the objects to be considered in these lessons may be widely different. Take nature and the experiences of your pupils as the guide in determining what to teach, where to commence, and how to proceed with your first lessons in elementary geography.

When teaching definitions, commence with those forms of land or water which the children most frequently see, whether a pond, lake, river, bay, island, plain, hill, mountain, or valley.

Do not commence your teaching of geography with the topic given in the first lessons of your text-book, because it is the first lesson in the book. Do not even select the same subject that you find given here to illustrate the manner of conducting the lesson, unless it happens to conform to the experiences of your own pupils.

How to Proceed.—Commence by asking simple questions that the children can easily answer, and by means of your questions and their replies direct the attention of your pupils to the subject of the lesson, and ascertain what they know about it. Suppose you select for your first lesson an island, something similar to the following might be your plan of proceeding:

About an Island.—Children, did you ever notice the two beautiful trees in the middle of the pond which you pass on your way to school? Did any of you ever walk over to those trees and sit

on the green grass in their shade? Why can you not walk to them?

"Because the water is deep all around them."

What do those trees grow on?

"On land."

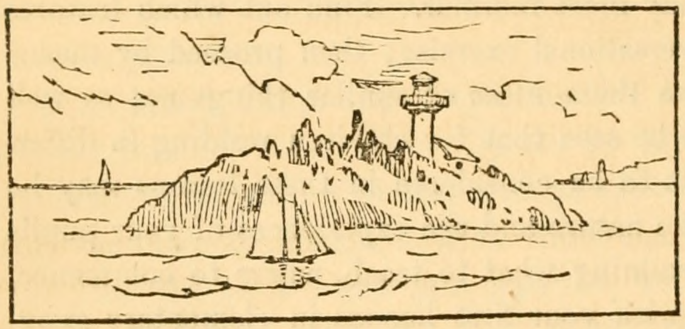
How could you get to those trees?

"By going in a boat."

What do you call a piece of land with water all around it?

"*An island.*"

Could there be an island without water? Could there be an island without land or rocks? What is an island?



I will make the picture of an island, and write what an island is, on the blackboard, and you may copy both on your slates.

An island is a portion of land entirely surrounded by water.

Who has seen any island besides the one in the pond? Where was the island that you saw? How many of you have walked on an island?

Should your first lesson be about a hill, you might conduct it somewhat as follows:

About a Hill.—How many in this class have sleds? What do you do with them?

"Draw them." "Ride on them."

When do you ride on them?

"When there is snow on the ground."

Did you ever ride on your sled without having some one to draw it? How could you do it?

You say you rode down a hill; how did you get on the hill?

"Walked up it, and drew my sled."

How many of you have seen a hill? How many have ridden down a hill on a sled? What do you call the highest part of the hill?

"The top."

What do you call the part of the hill on which you ride down?

"The side."

What do you call the part of the hill where your sled stopped?

"The bottom of the hill." "The foot of the hill."

Who will tell me what a hill is?

"A hill is a place where the land is higher than the land around and near it."

"A hill is a place where the land is elevated above the land near it."

Very well. You may say, *A hill is a small elevation of land.*

Now write on your slates what a hill is; and what the highest part, and the lowest part, are called?

If your first lesson be about a river near your school, the following questions will suggest the way of proceeding:

About a River.—Children, how many of you have seen the stream of water near the village? Do you think it a large stream? Is it deep enough for a boat to sail on it? What is this stream called?

Did you ever see a small stream of water? Can you tell me what a very small stream is called? Did you ever see the place where a *brook* commenced? What is such a place called? Is the water of a *spring* good to drink?

[Of course it is expected that the pupils will say something in answer to most of these questions. Their answers will suggest other questions.]

How many of you have seen one small stream flow into another stream? If many small streams should flow into another stream, what would these make of the other stream?

Did you ever see a large stream? What do we call a large, wide stream? How many of you have seen a river? What was the name of the river? Did any of you ever see any other river? Where was it?

When small streams flow into another one and make that larger, we call them *branches* of the large stream. Some rivers have a great many branches.

Who can tell me what a river is?

"*A river is a large stream of water.*"

Very good. What makes a river?

"*Many small streams of water flowing into one stream.*"

We say a river has a *head* and a *mouth;* which part of the river do you think is called the *head?* No one has given the right answer.

The place where the river rises, the spring where the water first comes out of the ground and makes the little stream, *is called its head.* Sometimes this place is called *its source; i. e.*, the place from

which the water first begins to flow. How many of you have seen a head of a river, or of a small stream?

Now you know where the *head* of a river is; can any one tell me where to look for *the mouth* of a river?

Do you know which part of a pitcher is called its mouth?

"That part where the water is poured out."

Now which part of the river may be called its mouth?

"The place where the water flows out."

Rivers flow into other rivers, or into a large body of water. The place where the river flows into a body of water is called *its mouth.* What is the mouth of a river?

What is the land along the sides of a stream or river called?

"*The banks or shores.*"

Now who can tell most about a river—where it begins—what that place is called—what makes a river—what the place where it ends is called—and what we call the land along its sides.

I will now write the best answers on the blackboard, and then you may copy them on your slates.

"A river is a large stream of water. The place where it rises is its head. Several streams flowing together make a river. The place where it ends is its mouth. The land along its side is called the bank or shore."

About a Plain.—Some of you have seen long level streets, and level lots, or fields, on each side of them. If you should go in the country where the land was level all around you for a long distance each way, you might call such a place *a plain.* How many of you have seen a plain? What is a *plain?*

"*A place where all the land is level.*"

About a Valley.—When you went to the river, a few days ago, to see the new steamboat, did you go uphill all the way? Did you go on a level road all the way?

You went downhill nearly all the way. Did you go downhill when you came from the river? When you were by the shore of the river, could you see the land on the other side? Did you see any hills on the other side of the river?

Then there were hills on both sides of the river; and the river flows through the low land between the hills. The low land between hills is called *a valley.* Where does the river flow?

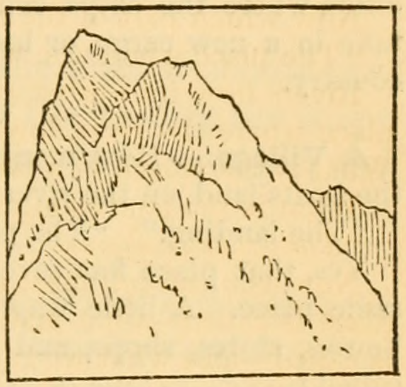
"Through the valley."

What is a valley?

"*A valley is low land between hills.*"

How many of you have seen a valley? Is this school-house in a valley?

About a Mountain.—Did you ever see a very large and high hill? Did you ever try to climb such a hill? Some hills are very large, and so high that it would take you many hours to climb up to the top; and when you reached the top you would find many rocks, but no trees. The cold wind would blow so hard there, even when the day is warm at the foot of it, that you would need very warm clothing, such as you wear in the winter. Sometimes the tops of these high hills are covered with clouds. We call such large and high hills *mountains.* Did you ever see a mountain?



Here is the picture of a mountain, on the blackboard. You may copy it on your slate, and write:

A mountain is a very high elevation of land.

About a Lake.—How many of you have seen the lake where the boys go skating in the winter, and the men go fishing in the spring? Does the water of the lake flow along, like the water in a river? What is on all sides of the lake?

"Land."

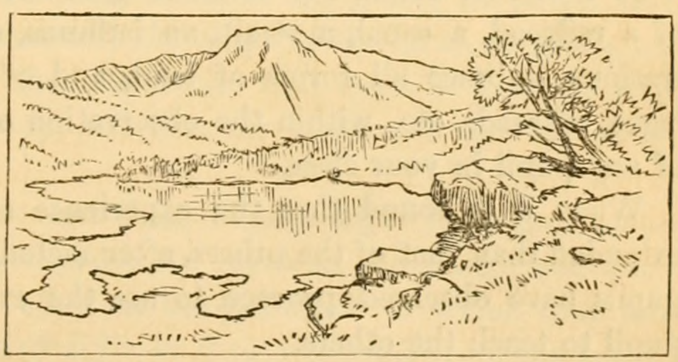
What is a lake?

"*A body of water surrounded by land.*"

Tell me some difference between an island and a lake.

Now tell me how the lake resembles an island.

I will make a picture of a *lake* on the blackboard, and you may draw it on your slate, and write a description of a lake.



A Bay.—You see in this picture that some parts of the lake extend into the land and then widen out. The part where the water thus extends into the land is called *a bay.* Did you ever see a part of a body of water called a bay? How many bays do you see in this picture of a lake?

A Cape.—The points of land which extend into the lake represent *capes. A cape is a point of land extending into the water.*

A Harbor.—When a part of a large body of water extends into the land, as a bay almost enclosed by land, ships go there for protection from a storm; and on the shores of such a place people build cities, where the ships can come to unload their goods, and then take in a new cargo, or load, to be conveyed to some other city or country.

A Village.—How many of you have been to the place where the boats land, on the river? What is that place called?

"The landing." "The pier." "The dock."

Yes, that place has several names, and each of them means the same place. A little way back from the landing-place are many houses, stores, shops, and several churches. What is that place called?

"A village."

How many of you have seen a village? Are there more houses in a village than on a farm? Why do people live in villages?

A City.—Suppose you should go to a place where there were a great many streets crossing each other, and houses built along both sides of these streets, and a great many stores, shops, churches, markets, etc., and many thousands of people lived in that place, would you call it a village? What would you call it?

How many of you have seen a city? Are the streets of a city like the streets in the country?

In a similar manner proceed to give the pupils definite ideas of a railroad, a canal, a strait, an isthmus, etc., until these illustrations embrace all forms of land, and of water, of farms, villages, railroads, etc., within the observation or possible experience of any pupil in your class.

When it is found that the experience of one pupil is more extended than that of the others, after including all that the other pupils have observed, proceed to use the experience of that one pupil to teach the others.

Show pictures, and make drawings on the blackboard to illustrate these lessons, as far as possible; and encourage the pupils to copy the sketches and the descriptions on their slates.

TO DEVELOP IDEAS OF THE EARTH'S SHAPE AND SIZE.

BEFORE commencing this lesson, the teacher should provide an ample variety of objects for illustrating the shape of the earth — such as peas, marbles, balls, oranges, and globes of different sizes.

First Step—Shape.—Lead the pupils to notice that the pea and marble are *alike in shape*—that these *represent the shape of the ball* and the orange. Lead them to notice, also, that while the ball and orange *have the same shape*, *they represent the shape of the globes.* Let them observe, also, that the pea, marble, ball, orange, and globe are *alike in shape* — that *each is a sphere.* Show a picture of the shape of the earth in a geography.

Lead the pupils to notice that each of these spheres *differs* from the others *in size* and in the *materials* of which they are formed.

How are the ball and pea alike? How do they differ?
In what are the orange and the globe alike? How do they differ?

Second Step — Size. — Remind the pupils that all the spherical objects before them *resemble the globes in shape*, and that these *globes* also *resemble the shape of the earth*, or globe, on which we live. Lead them to notice that these objects are like each other *in shape only*, and that *the globes are like the earth in shape only.*

Let them also notice that these objects *differ from each other in size;* that they *differ from the earth in size* also; and that they differ from each other in the *materials* of which they are composed; and they also *differ in their materials* from the earth.

This globe which I hold in my hand is like the earth in shape only. The earth is vastly larger than any globe that could be built. You could walk around a globe as large as could stand in

this room in less than two minutes; but you could not walk around the earth, even if there was a good path all the way, in *two years.*

A horse usually travels about five miles in an hour when drawing a horse-car; if a car track could be built around the earth, it would take *more than six months* to ride around it in a horse-car, even if the car should move on without stopping night or day.

If you could procure a kite-string long enough to reach around the earth, it would be 25,000 miles long; and should you try to wind it up, it would make a ball larger than the school-house.

Now I think you understand that the earth on which you live is a very, very large ball. It is so large that you can see only a small part of its surface at the same time. It does not appear to be round because it is so large that you can see only a small portion of it; yet we know that it is round, for many men have sailed around it. They can go around in a ship, somewhat as a fly can crawl around an orange.

Proofs that the Earth is Round.—1. People have sailed around it.

2. The body of a ship disappears first when it goes away on the sea. The masts are seen longer. A man six feet tall can see a *boat* about *three miles* distant on smooth water. If a man stands on a rock twenty-four feet high, he may see a boat when six miles distant.

3. When travelling toward the east the sun rises earlier each day —one hour earlier for each 1000 miles travelled.

4. The earth casts a circular shadow on the moon when the moon is eclipsed.

5. The earth is proved to be round from north to south by the changes in the positions of the stars in going far toward the north, or far toward the south. At or near the equator the north star would be in the horizon; at the north pole it would be directly overhead. In going south from the equator the stars appear to rise up higher and higher, the same as in going north from the equator.

Let there be frequent review exercises in which the pupils try to write some of the important facts of previous lessons. These exercises should be informal, not presented to the pupils as examinations. Rather let them be made competitive by requesting the pupils to try to write a given number of important facts learned during a previous, recent lesson; say two, three, or five facts, as may be deemed sufficient by the teacher.

REPRESENTATIONS OF THE EARTH'S SURFACE ON GLOBES AND MAPS.

Land and Water.—A few days ago we were talking about the shape of the earth. I then told you that this *globe* was made to show you the shape of the earth. Now I wish you to observe that its *surface* is not of the same color in all parts; and that it has on it something like pictures. These are intended to show you the shapes or boundaries of the land, and of the water on the surface of the earth. This part, of a light bluish color, represents the water; the other parts represent the land. You see there is much more water than land upon the earth.

James may point to parts of this globe that represent water. John may point to parts that represent land.

The large bodies of water represented here are called *oceans*. The large portions of land are called continents. These smaller portions of land, which are entirely surrounded by water, are called what?

"Islands."

Henry may point to something that represents an island on this globe.

William may point to a continent.

Some parts of the land are called valleys, some parts plains, some mountains, etc., as you learned in former lessons.

The water is divided into parts called oceans, bays, lakes, straits, rivers, etc. You cannot see anything on this globe to represent the small lakes, streams, mountains, etc., the globe is too small for that, so we must use large *maps* to represent the smaller parts of the surface of the earth.

Now I wish you to notice this large map, with the two large circles on it. This map represents the shapes of the bodies of water, and of the countries of the world.

On this left-hand circle you may see two large portions of land represented, which are joined together by a very narrow strip of land. Who will find these two bodies of land, and the place where they are joined, on this globe?

The two countries here represented, are called *North America*, and *South America*. We live in the one called *North America*. The strip of land which unites these countries is called an *isthmus*. Of what is an isthmus made? Is it narrow? What is at each end of

an isthmus? What is on each side of an isthmus? Can a person walk on an isthmus? What is an isthmus?

An isthmus is a strip of land that joins two larger portions of land together.

Point to an isthmus on this map of the world. Did you ever see a real isthmus?

Proceed in a similar manner to teach such forms of *land* and *water* as may be distinguished on both globe and maps.

How Locations of Countries may be Learned.— When the pupils have learned to point out on the map and globe the principal forms of land and water that may be distinguished on the globe, proceed with the location of the principal divisions or countries of the world, at the same time associating them with such people, animals, or productions found in them, as may be most familiar to the children. These lessons may be given somewhat as follows:

Yesterday we found the countries called North America, and South America, on the map and on the globe. To-day I wish you to find other countries on the map, and on the globe. On the left-hand circle of this large map you may see represented large bodies of land, and of water. You will notice that portions of the map representing land are of different colors. Each color is intended to show how much belongs to one country. Now James may come and find on the globe the country which I now point at on the map.

Right. This country is called *Africa*. It is the home of the negro race. Most of the people living in Africa are negroes.

William may now find the home of the negro race on this globe; and Henry may point to it on the map.

Please to notice the country which I now point out on the map. This is the home of the elephant, and of the Chinese; the country is called *Asia*.

Mary may find this country on the globe, and Lucy may point to it on the map.

Would you like to have me show you where fire-crackers are made? I will point to the place, and you must tell me what country it is in.

"Asia."

That is right, but that part of Asia where fire-crackers are

made is called *China*. That is where the *Chinese* live; and the place where our tea is raised. Now tell me the name of something that you have seen which came from Asia.

Now look at the country which I point out on the map. Is it as large as Asia? This country is called *Europe*. This country is the home of the *Germans*, the *French*, the *English*, the *Irish*, the *Scotch*, the *Italian*, the *Swede*, the *Dutch*, etc.

Who will find Europe on the globe?

Did you ever see any one who has lived in Europe?

George says he can find another large portion of land represented on the map; let him try it. Well done. That country is called *Australia*. It is the home of the *kangaroo*. Now George may find the home of the kangaroo on this globe.

I am now going to point to the representation of the country where the *camel*, and the *giraffe*, and the *hippopotamus*, and the *gorilla*, and the *ostrich* are found, and you must tell the name of the country.

"Africa."

Very good. *Lions* are found in Africa; and the *zebra* also. Egypt is in Africa; this is the place where the pyramids were built. The obelisk in the New York Central Park was brought from Egypt.

I will point to the country where pepper, cloves, cinnamon, and nutmegs grow, and you may tell its name.

"Asia."

The country that I am now pointing at is the home of the *llama*, and the place where cocoa-nuts, Brazil-nuts, and india-rubber are found. What is the name of this country?

"South America."

The largest river in the world is in South America. This is the Amazon river.

Who can find on the map the country where we live? What is the name of it?

This is the home of the *Indian*, and the *bison*, and the *bear*, and the *turkey;* and far to the north the white bear lives. The country there is very cold all the time. No large trees grow there.

The weather is very cold in the northern parts of *Europe* and of *Asia;* and it is also very cold far to the south of *Africa*, and of *South America*.

In the northern parts of South America, of Africa, of Australia, and in the southern parts of Asia, and of North America, the weather is very warm all of the time.

In the warm countries there are many large trees, and beautiful flowers, and birds with fine plumage.

Review these lessons on the locations of countries by calling upon pupils to point them out on the map, and on the globe. Let two pupils point out the same country, one on the map, the other on the globe; and require each to name something that can be found in the country.

Let pupils write on their slates all they can remember about a country, after the lesson has been given and reviewed.

MAP DRAWING AS A MEANS OF TEACHING GEOGRAPHY.

The practice of training pupils to sketch an outline of the boundaries of countries, states, etc., and to represent the chief features of each, as a part of the lesson on that country, is too much neglected in teaching geography. And this neglect leads to the leaving out of the methods of teaching this subject one of the most valuable means of success in learning it. Teaching a pupil to represent his knowledge by something done with the hand, is of greater importance than teaching him to remember something to say about it. He may learn to repeat the words without understanding what they are about; but he cannot learn to represent the form of that which he does not know.

A venerable teacher from whom I received many valuable lessons, used to say, "You know it when you can show it." This saying is specially appropriate to the student of geography. He knows the form and features of a country when he can show them by drawing.

The common question-and-answer method of recitations in geography is painfully familiar in too many schools. The pupils submit to it as one of the tiresome ordeals incident to school life. Compare a class of pupils taught

by this routine method, with one taught to sketch each feature of the country, the boundaries, locations of mountains, rivers, lakes, towns, and chief productions, and manufactures. Observe the listlessness of one class and the thoughtful attention and active interest exhibited by the other, and there can no longer remain a doubt as to which is the better way of teaching.

Accurately drawn maps are not necessary for this plan of teaching. They must possess sufficient resemblance to the true form for any pupil to recognize readily the country represented. With this degree of accuracy attained, rapidity of execution becomes chief in importance, when this sketching process is employed as a method of recitation, or review of lessons.

If you have neglected to use map sketching in teaching geography because you do not know how to draw a map accurately, do not allow this excuse to still prevent you from beginning. A little skill and patience on your part will enable you to lead your pupils to do the needed work in drawing; while your inability to draw well will prevent you from doing that which ought to be done by the pupils. Your effort should be to teach them to do for themselves. If you knew that you could draw maps well, you might try to do too much of the work, and thus prevent your pupils from attaining the best results from these lessons. By trying to teach map drawing, you will learn as well as your pupils.

How to Commence Map Drawing.—First read carefully what is said in the lessons on "Place and Direction" about representing the position of things on the table and in the class-room; and especially the lessons on *Boundaries and Maps.* Then give your pupils similar exercises, and when you find that your pupils can draw maps of the school-room, of the play-ground, and give the relative location of the streets and buildings in the

vicinity, they are ready to proceed with the drawing of maps to represent states, etc.

Suspend before the class a map of the United States, or of a group of states containing the one selected to be drawn. If the State of Pennsylvania be chosen, proceed somewhat as follows: Request the pupils to observe the general shape of the state, and to notice which way it is longer; whether the boundary lines are straight, or crooked; which sides are straight, and which are irregular; also notice about how many times the width of the state could be contained in its length.

Let each pupil take a slate and draw a line nearly across it, about two inches below the top, to represent the northern boundary of the state. Then let each pupil draw a line nearly across his slate, far enough below the first line to represent the southern boundary of the state. Next let each draw a line on the left side of the slate, meeting the other two lines, to represent the western boundary. In doing this lead them to represent the north-western corner of the state properly. Now call their attention to the irregular form of the eastern boundary. Request the pupils to make two dots to represent the two most easterly points in this boundary, and three dots to locate the most westerly points in it. Then direct the pupils to draw a line so as to pass through all five of these dots.

The slates may be compared, and the one best drawn selected. Request the pupil who drew that to represent the boundaries of the state on the blackboard. Then select some of the slates containing poorly drawn maps, and let the pupils compare them with the outline on the blackboard, and point out the defects.

This exercise will be quite enough for the first lesson; and the class will have learned enough of the shape of the state to be able to represent it much better, and in one-half the time, at the next lesson.

For the second lesson commence with the boundaries again, and request one pupil to draw them on the blackboard, while the others use their slates. Having finished the boundaries, request the pupils to tell you what was done after drawing the boundaries of the school-room.

"The position of the objects in the room were represented next."

Very well. Now we must represent the position of some objects in the State of Pennsylvania, within its boundaries. If you could look down upon the whole state, as you can look on the floor of this room, you would see chains of mountains in some parts, rivers in

others, coal mines, and iron mines, and oil wells, and cities, and railroads, in other places. You may represent the chains of mountains first; but, before doing this, look on the map and notice where the mountains are, and in which directions they extend.

The mountains that extend from about the middle of the eastern boundary toward the south-west, nearly to the middle of the southern boundary, are those of the Blue Ridge. Locate these first.

Next observe the position of the Alleghany range, and locate this. Then represent the other prominent mountains of the state.

Now let the class notice where the largest rivers are, and which way they flow, and then represent the Susquehanna, its east and west branches, the Juniata, the Alleghany, Monongahela, and the beginning of the Ohio. Next represent the part of Lake Erie that touches the state on the north-west.

Then select six of the principal cities, and locate each on the map. Philadelphia, Harrisburg, Pittsburgh, Reading, Scranton, and Williamsport.

In the north-western part indicate the region of oil wells; east of the centre of the state, represent the region of coal mines; and indicate the iron mines in the south-eastern and south-western portions.

Tell the pupils to remember that the State of Pennsylvania furnishes iron for our stoves, coal for our fires, and oil for our lamps.

They may next notice through what cities the principal railroads pass, and represent these by dotted lines.

The pupils may be requested to draw the same state again from observing the map; and then let them draw it from memory. Observing the following order:

1. Boundaries.	4. Cities.
2. Mountains.	5. Productions.
3. Rivers.	6. Railroads, etc.

Select another state with regular boundary lines, as Kansas, Colorado, Connecticut, Indiana, Iowa, and let the pupils proceed in a manner similar to the plan used for Pennsylvania.

Drawing from Dictation.—When the pupils have learned to draw maps of several states, request them to draw from dictation. *Teacher.* Draw a map of Connecticut, length of northern boundary about four inches. Draw northern boundary, eastern boundary, western boundary, southern boundary, giving an outline of Long Island Sound. Represent the Connecticut River, the Hou-

satonic River, the Thames. Locate Hartford, New Haven, Bridgeport, Norwich, Waterbury, and two principal railroads.

When the pupils are able to thus represent a state readily from dictation, let them try to draw a state in five minutes; then in four minutes; then to see how much they can draw in three minutes. This exercise will lead to a great saving of time in the recitations of geography, and secure a permanent knowledge of the characteristics of the several states.

Do not allow your pupils to waste time in tracing maps. Train them first to observe the general shape, then the relative size of its parts, and form of boundary lines, then to represent what they notice, with pencil or chalk.

An excellent review exercise may be had by requesting pupils to draw boundaries of a state; to write names of the states which touch it on the north, on the east, on the south, on the west; to locate its capital; three of its principal towns. This work should be performed rapidly.

It will be found valuable in this connection to drill the pupils in locating chief commercial cities, in such a way as to represent the general direction and relative distance of one from the other, as New York, Boston, Philadelphia, Buffalo, Chicago, St. Louis, New Orleans, San Francisco; or Cincinnati, Columbus, Cleveland, Dayton, Toledo; or New York, Albany, Syracuse, Rochester, Buffalo; or Chicago, Detroit, Milwaukee.

Map drawing may be extended to the continents, and to all the principal countries. Valuable suggestions to aid in this work may be found in the principal text-books on geography.

WEIGHT.

"THINGS before words," should be an ever-present motto with the primary teacher. The remembrance of this is of especial importance in developing ideas of *weight*, a knowledge of which can be obtained only from objects, and through the appropriate sense. *Lifting must teach the child differences in the weight of things.* No idea of this property of objects can be communicated to the mind of the child by words alone. The pupil must teach himself this subject by his own experiences, or forever remain in ignorance of it.

What, then, is the teacher's function with this subject of instruction? It is to provide suitable materials, and the opportunity whereby the child can get the necessary experience with things that have weight; and then to guide the pupil in the use of the materials so that he may secure the best results in the least time. The teacher must instruct the child by directing him how to use the objects provided in teaching himself. Here, emphatically, that which the child does, teaches him.

For suitable materials to develop ideas of weight, provide balls and cubes of the same size but of different materials, as cork, wood, yarn, rubber, glass, iron, lead; also cubes and balls made of the same materials, but of different sizes; also large objects that are light, and small objects that are heavy; small bags of feathers, wool, cotton, bran, beans, shot; four tin boxes of the same size, containing respectively one ounce, two ounces, four ounces, and

eight ounces of shot; two equal phials, one containing quicksilver, the other water; also four *one-ounce* weights, two *two-ounce* weights, two *four-ounce* weights, two *eight-ounce* weights, one *pound* weight, and a pair of common counter scales.

The following *steps* are intended to suggest the order of proceeding, and the general plan of instruction appropriate to this subject.

First Step.—The first ideas of weight must be gained by *observing differences* in the weight of objects.

Second Step.—Next in the order of progress comes the *comparison of weights* to distinguish those that are similar.

Third Step.—Pupils to learn by lifting and *weighing* to distinguish given weights.

EXERCISES TO DEVELOP IDEAS OF WEIGHT.

FIRST STEP, FOR OBSERVING DIFFERENCES.

First Exercise.—Let the pupils lift many objects without regard to size or shape, and notice that they differ in weight.

Second Exercise.—Let the pupils lift objects of the same material which differ much in size and in weight.

Third Exercise.—Let them lift objects of equal size and same shape, but of different materials, and observe that they differ in weight.

Fourth Exercise.—Let them lift objects, as tin boxes, of same shape and size, but differing in weight, and thus learn to distinguish differences.

SECOND STEP, FOR COMPARING WEIGHT.

First Exercise.—Let the pupils lift objects, without regard to size or shape, and find two or more of the same weight.

Second Exercise.—Let them lift large and small objects, and find two that differ in size which are alike in weight.

Third Exercise.—Let the pupils hold one object, and lift others to find those that are lighter and those that are heavier than the one held.

Fourth Exercise.—Let the pupils take a basin of water, and find what objects will sink in it and what objects will swim. Teach them that objects which are heavier than water sink, while those which are lighter than water swim.

THIRD STEP, FOR WEIGHING.

First Exercise.—Let the pupils take a given weight, as four ounces, or half a pound, or one pound, and compare the weight of other objects with it by lifting; then let them try these on the scales to see if the weight of each is the same.

Second Exercise.—Let them lift an object, judge of its weight, then weigh it to test the correctness of the judgment.

Third Exercise.—Let the pupils take a *quarter-pound* weight, place it on the scale, and then find how many ounce weights will equal it in weight. Let them take a *half-pound* weight, and in the same way find how many ounce weights will equal it. Proceed in the same manner to find how many ounces equal a *pound* weight.

Several lessons should be given under each of the preceding exercises, which will supply the pupils with enough personal experience to develop clearly the special ideas intended to be taught by each of the three *steps.* The pupils should also be encouraged to make similar experiments at home, and then tell in school what they have learned concerning the given step. At the end of the exercises for the Third Step, the pupils will be prepared to learn readily and understandingly the *tables of weights.*

THE NECESSITY OF STANDARD WEIGHTS.

Teacher. If you should go to the grocery store to buy coffee, tea, sugar, and flour, what would you say, in telling how much you wanted to get?

Pupil. I would tell the clerk to give me a pound of coffee, and half a pound of tea. Then, if I wanted some flour and sugar, I would tell him to give me ten pounds of flour and seven pounds of sugar.

T. What would the clerk do to find how much he must give you of each article?

P. He would weigh them on the scales. He has half-pound weights, pound weights, two-pound weights, five-pound weights, and other large weights, and he could use these to find how much to give me of each article.

T. Suppose the grocer had no scales and no weights, and did not know how to weigh, how could he give you what you asked for?

P. He could not do it. He must have scales and weights, and know how to weigh, or he could not keep a grocery store.

T. Now you may name all the articles that you can think of that the grocer sells by weight.

FACTS ABOUT WEIGHT, FOR THE TEACHER.

The pupils having learned by experience with the scale and weights that 16 ounces make one pound, 8 ounces one half pound, 4 ounces one quarter of a pound, the following table may be written on the blackboard and copied by the pupils on their slates, then memorized, so that they can repeat it in order, or answer any question as to how much of one weight it takes to make another weight.

COMMON, OR AVOIRDUPOIS WEIGHT.

16 ounces make one pound.	Sign: *oz.* for ounce.
8 " " one half pound.	" *lb.* for pound.
4 " " one quarter of a pound.	
100 pounds make one hundred-weight.	" *cwt.* for 100 pounds.
20 hundred-weight make one ton.	
2000 pounds make one ton.	

For pupils who are advanced beyond the simple rules of arithmetic, the following tables are given:

MISCELLANEOUS COMMON WEIGHT.

7000 grains make one pound.	Sign: *lb.* for pound.
60 pounds one bushel of wheat.	" *bush.* for bushel.
196 " " barrel of flour.	" *bbl.* for barrel.
200 " " " " beef or pork.	
280 " " " " salt.	
2240 " " old ton, or gross weight ton.	
100 " " quintal of fish.	
144 " avoirdupois equal 175 *lbs.* troy.	
192 ounces " " 175 *oz.* "	
1 ounce " " 437½ *grains.*	
1 " troy " 480 "	
1 grain " " 1 grain avoirdupois.	
1 pound " " 5760 grains.	

TROY WEIGHT.

Explain the use of this weight. Compare the grains, ounces, and pounds with those of *common weight.* Let the pupils see that the common pound is heavier than the troy pound, by 1240 grains; and that the ounce of troy is heavier than the ounce in common, or avoirdupois weight, by 42½ grains.

24 grains make one pennyweight.	Sign: *dwt.* for pennyweight.
20 pennyweights make one ounce.	" *oz.* for ounce.
12 ounces make one pound.	" *lb.* for pound.
5760 grains " " "	
480 " " " ounce.	

APOTHECARIES' WEIGHT.

Explain its use for mixing medicines. Lead the pupils to notice that the *pound*, *ounce*, and *grain* are the same as in troy weight; that the only difference between the troy and apothecaries' weight consists in the subdivisions of the ounce into *drachms* and *scruples.*

20 grains make one scruple.	Sign: ℈.
3 scruples " " drachm.	" ʒ.
8 drachms " " ounce.	" ℥.
12 ounces " " pound.	
480 grains " " ounce.	
5760 " " " pound.	

DIAMOND WEIGHT.

In this weight the *grain* is equal to $\frac{4}{5}$ of a troy grain; and the diamond grain is divided into sixteen parts:

16 parts make one grain.
4 grains " " carat.
1 carat equals $3\frac{1}{5}$ grains troy.

Some idea of the rate at which the value of diamonds increases as the weight increases may be understood from the following statement: If a rough diamond weighing *one carat* is worth \$9, a cut diamond weighing one carat is worth \$36; and a cut diamond weighing *two carats* would be worth four times \$36, or \$144; one weighing *three carats*, nine times \$36, or \$324. To get an idea of the relative value of diamonds of equal purity and different weight, *multiply the price of one carat by the square of the weight in carats.*

An Assay Carat means *one-twenty-fourth part;* 20-carat gold contains 20 parts of pure gold and 4 parts alloy; 18-carat gold contains 18 parts of pure gold and 6 parts alloy.

WEIGHT OF OBJECTS.

The teacher may give interesting exercises by showing the pupils what objects are lighter than water, which are heavier than water, and how many times heavier; and thus develop more fully ideas as to heavy and light objects.

Fill a glass jar with water, and place it on a table before the class. Put in the water a *cork* cut in the shape of a cube, also pieces of *poplar*, *pine*, *maple*, and *oak* wood cut in the same shape and size. Let the pupils notice which sink lowest in the water. Try a piece of ice in the same way, and they will see that about $\frac{1}{12}$ of it will remain above the water. Also, place in the water objects that are heavier than water, and let the pupils observe that some sink slowly, that others sink quickly.

The following tables will furnish facts that will aid the teacher in making experiments, which will lead the pupils to gain much useful information about the weight of objects:

COMPARATIVE WEIGHTS.

Steam	is	lighter than	gas.
Gas	"	"	air.
Air	"	"	cork.
Cork	"	"	poplar wood.
Poplar	"	"	pine wood.
Pine	"	"	ice.
Ice	"	"	fresh water.
Fresh water	"	"	salt water.
Oil	"	"	water.

LIGHTER THAN WATER.

Steam	is about	$\frac{1}{1300}$	as heavy	as water.
Air	"	$\frac{1}{800}$	"	"
Cork	"	$\frac{1}{4}$	"	"
Poplar	"	$\frac{2}{5}$	"	"
Pine	"	$\frac{1}{2}$	"	"
Maple	"	$\frac{2}{3}$	"	"
Oak	"	$\frac{9}{10}$	"	"
Oil	"	$\frac{9}{10}$	"	"
Ice	"	$\frac{11}{12}$	"	"

HEAVIER THAN WATER.

Milk	is about	$1\frac{1}{30}$	times	as heavy	as water.
Coal	"	$1\frac{1}{2}$	"	"	"
Brick	"	2	"	"	"
Slate	"	$2\frac{2}{3}$	"	"	"
Glass	"	3	"	"	"
Diamond	"	$3\frac{1}{2}$	"	"	"
Garnet	"	$4\frac{1}{5}$	"	"	"
Cast iron	"	$7\frac{1}{5}$	"	"	"
Copper	"	$8\frac{3}{4}$	"	"	"
Silver	"	$10\frac{1}{2}$	"	"	"
Lead	"	$11\frac{2}{5}$	"	"	"
Mercury	"	$13\frac{3}{5}$	"	"	"
Gold	"	$19\frac{1}{3}$	"	"	"
Platinum	"	21	"	"	"

METRIC MEASURE.

This system is now extensively used in eleven countries of the world, and is being introduced into the United States. Could all the instruction in school pertaining to the tables of weights and measures be confined to the metric system, it would save about one year in the school life of each pupil who completes an ordinary grammar-school course; and could the power of habit produced by long use of the present tables be overcome; and could the people be induced to make use of these tables in business transactions, the saving of time in business would be greater than the saving of time in school. Although so great a saving of time would be effected by making all our tables of weights and measures as simple as that of our table of money, which is part of a metric system, it is not very probable that this system will come into general use in this country during the present century.

Its simplicity may be seen in the fact that it is necessary to remember only *three terms* as the key, or units in all the measures and weights by this system, for

All *lengths* are measured in *metres.*
" *capacities* " " *litres.*
" *weights* " " *grams.*

With the *metre* every possible dimension—length, surface, solidity—can be measured; with the *litre*, every possible capacity; and with the *gram*, every possible weight.

Parts of each of these three unit measures are represented by the same terms — a tenth, by *deci;* a hundredth, by *centi;* a thousandth, by *milli.*

For representing lengths, capacities, or weights greater than the unit, each increases by a decimal ratio, as in our money. Ten units, a hundred units, and a thousand units, of either measure or weight, would be represented by the same terms, thus:

deka signifies *ten of the unit; hekto*, a *hundred of the unit; kilo*, a *thousand of the unit;* and *myria*, *ten thousand of the unit;* hence *ten metres* would be called a *dekametre; ten litres*, a *dekalitre; ten grams*, a *dekagram;* and a *hundred metres* would be a *hektometre;* a *thousand litres* would be a *kilometre; ten thousand grams* would be a *myriagram.*

In the same manner a *tenth* of a metre would be a *decimetre;* a *hundredth* of a litre would be a *centilitre;* a *thousandth* of a gram would be a *milligram.*

These terms may be abbreviated in use to *decim*, *centim*, *millim;* or *dekam*, *hektom*, *kilom*, *myriam.*

COMPLETE METRIC TABLES.

Dollar is a measure of values.	*Litre* is a measure of capacities.
Metre " " " " lengths.	*Gram* " " " weights.

Deci means tenth.	*Deka* means ten.
Centi " hundredth.	*Hekto* " hundred.
Milli " thousandth.	*Kilo* " thousand.

Myria means ten thousand.

How to Read Metric Numbers.—When we write 9 eagles, 5 dollars, 7 dimes, 5 cents; we read it, 95 dollars 75 cents.

When we write 7 *kilom*, 2 *hektom*, 8 *dekam*, 6 *metres*, 3 *decim*, 5 *centim;* we read it, 7 thousand 2 hundred, 86 *metres* and 35 *hundredths.*

When we write 8 *myriagrams*, 5 *kilograms*, 3 *hektograms*, 6 *dekagrams*, 4 *grams*, 5 *decigrams;* we read it, 85 thousand 3 hundred and 64 *grams*, and 5 *tenths.*

For addition or subtraction, write the figures the same as in United States money.

\$386 25	*m*.386 25	*g*.386 25
27 10	27 10	27 20
148 75	148 75	148 75
54 30	54 30	54 30
\$616 50	*m*.616 50	*g*.616 50

These answers may be read as follows: six hundred sixteen dollars and fifty cents; six hundred sixteen metres and fifty hundredths; six hundred sixteen grams and fifty hundredths.

Subtraction, multiplication, and division in the metric system would be performed the same as in United States money.

The abbreviations are simple, *m.*, *l.*, *g.*, for *metre*, *litre*, *gram; d.*, *c.*,

for *deci*, *centi; d.*, *h.*, *k.*, *m.*, for *deka*, *hekto*, *kilo*, *myria; dm.* for *decimetre; Dm.* for *dekametre.*

Values of Metric Quantities.—A *metre* is one ten-millionth of the distance from the equator to the pole, or nearly 40 inches.

A *litre* is a cubic tenth metre (decimetre), and is about equal to our quart.

A *gram* is the weight of a cubic hundredth metre (centimetre), of water; and is about $\frac{1}{30}$ of an ounce.

Four steps equal about three metres.

The width of the hand is a decimetre; and the width of a finger two centimetres.

Our nickel five-cent coin weighs five grams; its diameter is two centimetres.

Our three-dollar gold coin weighs five grams; and two silver dimes weigh nearly five grams.

Our gold dollar equals more than *five francs* of the French money, or 5.1826 francs.

In the use of the metric system, carpets would be measured by *metres;* long distances by *kilometres;* short lengths by *decimetres*, as lengths from four inches to the length of the metre; and lengths less than four inches by *centimetres*, or *millimetres.*

Measure liquids, small fruits, etc., by *litres;* fruits and vegetables in quantities larger than our peck by *dekalitres*, or *hektolitres;* wines and other liquids in large quantities like our barrel, in *hektolitres.*

Weigh medicines and small articles by *grams;* sugar, flour, coal, hay, by *kilograms.* A thousand kilograms is about one ton.

Measure surfaces by *square* metres, *square* centimetres, etc. Measure *solids*, as wood, etc., by *cubic* metres, *cubic* centimetres, etc.

FORM.

ADDITIONAL METHODS FOR ELEMENTARY LESSONS.

TEACHERS learn by experience that success in training pupils to understand a subject depends very much upon ability to present the lessons in different ways; and upon furnishing something for the pupils to do by way of showing that they understand each fact stated, and notice each step taken. Those who teach large classes especially need to be familiar with a great variety of methods for bringing the same subjects before their pupils, to keep up the interest of each until all understand the lesson.

For the purpose of adding to the variety of methods of teaching *Form*, as given in the *Primary Object Lessons*, the following suggestions are presented. These methods are not intended as substitutes for those in that book, but as additions thereto; and while intended partly as ways for reviewing those lessons, their chief purpose is to furnish a greater variety in the modes of teaching *Form*. A leading idea pervading these methods is that each pupil in a large class shall be constantly supplied, during the entire exercise, with something *to do*.

Lines.—Having given the pupils ideas about *kinds* and *positions* of lines, place in the hands of each pupil two small splint-like sticks of equal length—such as are used for lighting lamps.

1. If the class is composed of quite young pupils, let their first exercise be the holding of splints in imitation of the teacher, as she represents the position and gives its name, somewhat as fol-

lows, viz.: "vertical position;" "horizontal position;" "oblique position;" "perpendicular position;" "parallel position."

2. As the *second step* the teacher may *draw lines* on the black-board representing each of the positions illustrated before, and request the pupils to name it when drawn, and represent it with the splints.

3. For a *third step* the teacher may *name the positions* without representing them by lines, and require the pupils to represent each with splints, as the name is given.

Angles.—Having given one or two lessons on *angles*, as described in the *Primary Object Lessons*, distribute the splints, giving two to each pupil. Let all the pupils imitate the teacher as she represents each angle with splints, and names it.

Next draw each angle on the blackboard, and request the pupils to name them, as drawn; also represent them with the splints, held by the thumb and forefinger, at the angle.

For a change in the exercise the teacher may name each angle, and all the pupils represent it with splints or with their fingers.

Plane Forms.—When the pupils have had lessons on the *square* and *oblong*, provide them with each shape cut from strong paper—manilla paper is best for this purpose.

First.—The teacher may hold up one of these forms, and request all the pupils to hold up a like shape and to give its name. The teacher may hold up the other form, and the pupils do as before.

Second.—The teacher may name each form, and request all the pupils to hold it up as the name is given.

Change this by asking the pupils to hold up a form that has *two equal long sides*, and point to these sides. Then ask them to hold up the form that has four equal sides; then the one that has two equal short sides. Let them count the right angles of each form.

Square and Rhomb.—Give an exercise with the square and rhomb, as with the square and oblong. Request the pupils

to find wherein the square and rhomb are alike; also wherein each differs from the other.

Rhomb and Rhomboid.—Give each pupil a paper rhomb and rhomboid, and proceed as with the last two exercises.

Triangles.—Triangles may next be taken; using the right-angled, acute-angled, and obtuse-angled triangles. When the pupils can readily state and point out the distinguishing parts of each of these triangles, give a similar exercise with equilateral, isosceles, and scalene triangles.

These exercises may be changed by requesting the pupils to fold or cut pieces of paper at home to represent the forms of a lesson, after the school exercise has been had. The paper forms thus made should be brought to school the next day for the teacher to examine; and the best forms may be shown to the class and commended; while the poorer ones may be used for pointing out the mistakes made. But this should be done without allowing the pupils to know whose form is criticised.

Circles, etc.—Provide forms of paper representing circles, semicircles, rings, crescents, ovals, and ellipses, and give exercises similar to those with the square, rhomb, etc. Lead the pupils to notice the difference between the semicircle and the crescent; also between the oval and the ellipse.

Polygons.—During a later stage of instruction, similar exercises may be given with the polygons—pentagon, hexagon, heptagon, octagon, etc.

Folding Squares.—Give each pupil a paper square, and request the class to fold the paper so as to make an oblong; then to fold it again, so as to make a small square.

Next, having unfolded the papers, let them fold the square so as to make right-angled triangles. Then let them tell how it was folded, as, "Folding a square through its centre from corner to corner will make a right-angled triangle."

Then let them fold this triangle again, and make a smaller right-angled triangle. Lead pupils to notice that in the folding of the triangle it is "folded from the middle of the long side to its opposite corner."

Folding an Oblong.—In a similar manner teach the pupils to fold oblongs into other oblongs, also into squares and into triangles.

Folding Rhombs.—Let the pupils fold a rhomb through its centre and the nearest opposite corners, and make equilateral triangles.

Folding Equilateral Triangles.—Fold the equilateral triangle from the middle of one side to its opposite corner, and make right-angled triangles.

Let the pupils also fold rhomboids, and notice what kind of triangles can be made.

Folding Circles.—First fold circles so as to make *semicircles;* next fold into quadrants. Let the pupils notice how many quadrants can be made from one circle.

Fold the circles into six equal parts—call these *sectors;* let the pupils compare the shape and size of these with quadrants.

Fold the circle into eight equal parts; count the sectors; compare them with quadrants.

Request the pupils to cut and fold these forms at home.

REVIEWING FORM LESSONS.

Good methods of teaching provide for reviews of each subject taught, to gather up and fasten the important facts in the pupil's mind. The real progress of the learner can be determined only by such a review as will show what the pupil retains of the subject, and what mental powers have been strengthened by his attention to that subject.

In conducting the review the intelligent teacher will use such methods of testing the amount of knowledge acquired, and the learner's ability to think upon the subject, as will *prevent the giving of answers in formal, memorized phrases.*

The review should not attempt to cover the minute particulars embraced in the processes of instruction, but aim rather to ascertain what essential facts have been secured by the pupil; and thus prepare for extending the instruction upon the same or a kindred subject.

It is very important that the review should be as brief and comprehensive as the circumstances will permit, with due attention to the essential facts. The review should take place as each successive stage of the subject, or period of instruction, is completed.

For the further illustration of this matter it is proposed, in this connection, that a review be had of the lessons which are outlined in the *Primary Object Lessons* under the head of *Form;* and that this review shall be preparatory to subsequent and advanced lessons upon the same subject.

In order to suggest methods by which teachers may determine whether the pupils have obtained real knowl-

edge concerning the object or lesson, or have learned only *words about it*, the following questions and directions are presented as suggestive of a mode of testing the result of the instruction; but these are not given for the teacher to follow literally. In every instance the questions or the directions should be adapted by the teacher to the condition and circumstances of the pupil, and be suggested chiefly by his previous answer to a question or by his statement upon the subject under consideration.

REVIEW EXERCISES.

Lines, and their Positions.—Hold a string so as to represent a straight line.

Hold a string so as to represent a curved line.

Draw straight and curved lines on your slate.

What kind of line does the cord represent when it is wound around a top?

Place a string on the table so that it will represent a spiral line.

In what position is the kite string when the kite is high in the air?

Hold two pencils so as to represent parallel lines.

Draw vertical, oblique, and horizontal parallel lines on your slate.

Hold one pencil perpendicular to another pencil.

Hold a pencil perpendicular to the side of the desk.

Angles.—Take two pencils and represent an *acute angle;* a *right angle;* an *obtuse angle.*

If you should cut a circular pie into four equal parts, what angles would be formed?

If a pie be cut into three equal pieces, what kind of angle would each piece have?

If a pie be cut into six equal pieces, what kind of angle would each piece have?

If one boy had a piece of pie with an obtuse angle, another a piece with a right angle, and another a piece with an acute angle, which boy would have the largest piece of pie, and which the smallest piece?

Plane Forms.—How many lines must you make in drawing a square?

How many lines in a triangle ?

How many lines in an oblong ?

Could you make an oblong with four equal sides ?

Triangles.—When all the sides of a triangle are equal, what is the name of it ?

How many right angles can a triangle have ?

How many obtuse angles can a triangle have ?

If a triangle has one right angle, or one obtuse angle, what must the other two triangles be ?

How many acute angles *must* each triangle have ?

How many acute angles has a right-angled triangle ?

How many acute angles has an acute-angled triangle ?

How many has an isosceles triangle ?

What kind of angles has a scalene triangle ?

How would you cut a square in half so as to make two triangles ?

Rhomb.—If you should draw a plane figure with four equal sids, two acute, and two obtuse angles, what woul d be its shape ?

Where is the difference between a square and a rhomb ?

Polygons.—What kind of angles do pentagons, hexagons, heptagons, octagons, etc., have ?

Oval.—What is the difference between an oval and an ellipse ?

How could a hard-boiled egg be cut so as to represent an oval ? Try it at home.

Circle.—How could a boiled egg be cut so as to represent a circle ?

How could you cut a circle from an apple ? Try it.

If you cut a circle in half, what will be the shape of each part ?

What have you eaten that had the shape of a circle ? of a square ? of an oblong ?

Solids.—Could you make a cube of an apple ? of a piece of cake ? of a slice of bread ?

How would you make it ?

[*Ans.* Cut it so that it would have six equal square sides.]

Did you ever eat a cube ? What was it made of ? What would you like to have a cube made of if you must eat it ?

If you should cut a slice from the side of a cube, what would be the shape of the slice ?

Did you ever eat a sphere? What was it made of?

Did you ever eat a cylinder?

Could you make a cone of something good to eat?

Did you ever eat anything of the shape of an ovoid?

Could you cut a square prism from a slice of bread-and-butter?

Could you make a pyramid from a potato? What is the shape of the sides of all pyramids?

Could you make a sphere from a hard-boiled egg? How would you make a hemisphere from an orange? How many hemispheres could you make from a very large orange?

If you break a cylindrical stick of candy in half, what will be the shape of each piece?

What shape are the sides of all prisms?

What shape must the base of a cube have?

Can a cylinder have a square base?

If a prism has six equal oblong sides, what must be the shape of its ends?

The foregoing questions and directions will suggest many others for reviews. The questions for this purpose should be so formed as to lead the pupils to discover new facts and relations in the lessons on *Form*.

ADVANCED LESSONS ON FORM.

Point.—Make a small dot on your slate. You may call that dot a *point*. Has the point length? Has the point breadth? Has the point thickness?

A point has neither length, breadth, nor thickness. It has position only. A point has no magnitude or dimension.

Line.—Make two points on your slate. Draw a line from one point to the other. Has the line length? Has the line breadth? Has the line thickness?

A line has neither breadth nor thickness. It has length only. A line is a magnitude of one dimension.

Surface.—Make four points on your slate to represent the four corners of a square. Draw lines so as to connect these dots. Move

your finger from one side to the other of this square; move it from the top to the bottom of the square. That part within these lines is the *surface.* Has the surface length? Has the surface breadth? Has the surface thickness?

A surface has length and breadth. It has no thickness. A surface is a magnitude of two dimensions.

Figure.—A *form* that is represented by a plane surface is called a *figure.* The size and shape of a figure are determined by lines.

Boundary.—How many straight lines form the sides of this square? How many straight lines has the triangle? How many lines has the circle?

The lines that form the sides of plane figures are the BOUNDARIES of those figures.

The boundaries of a triangle, a square, or rhomb are called its *sides.* The boundary of a circle is its *circumference.*

How many boundaries has a triangle? How many has a square? How many has a rhomb? How many has a pentagon? How many has an octagon?

Linear Figures.—Figures that are bounded by lines are called *linear figures.* What is the least number of lines that will bound a linear figure? What kind of line must be used?

What is the least number of straight lines that will bound a linear figure?

What linear figures are bounded by two lines? (*Semicircle, segment, crescent.*) Represent a figure bounded by two lines.

Make three different figures, each bounded by one line, and write the name of each figure in it. (*Circle, oval, ellipse.*)

Make a figure bounded by two curved lines, and write its name.

Quadrilateral.—Figures that have four sides or boundaries are called *quadrilaterals;* as square, rhomboid, trapezium, trapezoid, etc.*

Parallelogram.—Figures that have their opposite sides parallel are called *parallelograms;* as, squares, oblongs, rhombs, rhomboids.

Polygon.—Figures that have more than four sides are called *polygons.*† Regular polygons have equal sides, and equal angles.

Make six kinds of *quadrilaterals*, and write the name of each.

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* See *Primary Object Lessons*, pp. 97, 99, 101, 102. † *Ibid.*, pp. 103, 104, 105.

Make four kinds of *parallelograms*, and write the name of each.

Make six differing figures each bounded by three lines, and write their names.

When may we call a plane figure with two equal acute, and two equal obtuse angles a rhomb?

What form may be produced from a rhomb by so changing its angles as to make them all equal?

How many squares can you draw around a single square, so that one side of each shall be bounded by one of the sides of the single square? Try it.

How many squares can you place around one square, so that it shall be touched by each square?

Diagram.—When a plane form is spoken of with regard to its *shape*, it is called a *figure*. When several lines are arranged so as to represent two or more combined figures for the purpose of illustration, it is called a *diagram*.

Draw a *figure* on your slate.

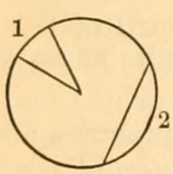
Draw a *diagram* on your slate.

Circle and its Parts.*—Direct the pupils to draw six circles on their slates with a string and pencil. Write above them the name of the figures; and write around the first circle the name of the *boundary*, and in the circle the name of the *point in the middle*.

Divide the second circle into two equal parts, and write the name of the parts on one of them.

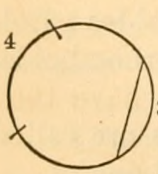
Divide the third circle into four equal parts, and write the name of the parts on two of them.

Draw a line on the fourth circle to represent the greatest distance across it, and write the name of it on the line; also, draw another line half the distance across the circle, and write its name on it.



Draw lines in the fifth circle to represent a *sector*(1) and a *segment*(2), and write the name in each.

Draw lines on the sixth circle to represent a *chord*(3) and an *arc*(4), and write the name by each. Lead the pupils to notice the differences between a *sector* and a *segment;* also between a *chord* and an *arc*, and to point out each.



Request the pupils to state what is represented in each circle. Lead them to notice that all the diameters of the same circle are equal; that all the radii of the same cir-

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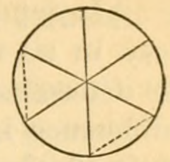
* See *Primary Object Lessons*, pp. 106, 108, 111–114.

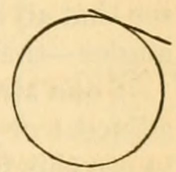


cle are equal; and that the radius is always half of the diameter.

Lead them also to notice that the *chord* of the arc of a *sextant* of any circle equals the radius of that circle. The dotted lines represent the *chord* of the arc, in this cut. Let the pupils prove this equality with a pair of compasses.

Sextant.—Draw a circle and divide it into six equal parts, or *sectors*. Each of these parts may be called a *sextant*.

If a circle be divided into eight equal parts or *sectors*, each part may be called an *octant*.



Tangent.—Draw a circle; then draw a straight line so that it will pass the circle, just touching its circumference. This line is called a *tangent*. The radius of the circle forms a right angle with the tangent.

Degrees.—Every circle contains 360 degrees.

When a circle is divided into four equal parts, what is each part called?

How many *degrees* has the curved side of each quadrant?

How many degrees has each right angle?

Which contains more degrees, a right angle or an obtuse angle?

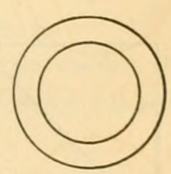
That which any angle lacks of being a right angle, *i. e.*, that which it lacks of 90 degrees, is the complement of the angle.

What part of a circle is 90 degrees? What part is 45 degrees? What part is 180 degrees?

How many degrees would an object elevated 75 degrees lack of being vertical?

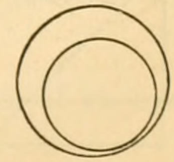
The sum of three angles of a triangle is 180 degrees.

Each of the angles of an equilateral triangle is one-third of 180 degrees, or 60 degrees.



Concentric Circles.—When one or more circles having the same centre are drawn within a circle, they are called *concentric circles.*

Make two concentric circles. Draw four concentric circles. Are any two of the circles in the same concentric circles of the same size? Do two of the circles have the same centre?



Eccentric Circles.—When two circles, one within the other, have *not the same centre*, they are called *eccentric circles.* Make eccentric circles.

About Angles.—The length of the lines that form an angle can in no way affect the size of the angle. The size of an angle is determined by the size of the opening between the lines, or the difference in the direction of the two lines. Illustrate this with a pair of scissors and by lines on the blackboard.

Two right angles are equal to each other. Draw two, and let the pupils compare them.

All the angles formed on the same side of a straight line, by other lines meeting at the same point, are equal to two right angles. Show this fact by drawing a straight line, and, from a point near the centre, extend lines so as to form angles of different sizes, and let the pupils see that all the angles thus made occupy the same space as two right angles—that they are equal to only two right angles.

If one straight line meet another straight line, the *sum* of the two adjacent or joining angles equals two right angles. Lead the pupils to see this fact by drawing such lines and angles on their slates.

Triangles.—The three angles of a triangle equal two right angles.

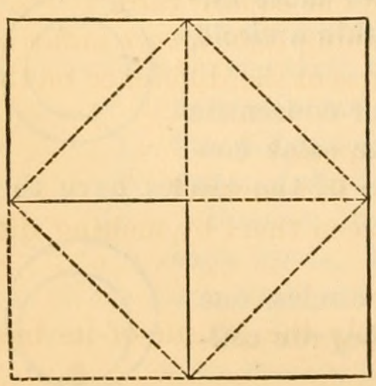
How many equilateral triangles can be placed together so that a point of each shall touch a point of all the others? Cut equilateral triangles from thick paper, and let the pupils find an answer to this question; and observe what *form* will be thus produced.

The largest triangle that can be drawn within a circle is an equilateral triangle. Let the pupils try to draw it on their slates.

The area of a circle *inscribed* in an equilateral triangle is one-fourth of the area of a circle *circumscribed* about the same triangle.

The area of an equilateral triangle inscribed in a circle is one-fourth of the area of an equilateral triangle circumscribed about the same circle.

Squares.—**1.** A square drawn on the diagonal of another square is just twice as large as the first square. Represent this fact by drawing two such squares; and let the pupils learn it by drawing squares on the diagonals of other squares.

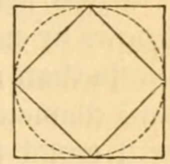


2. A square drawn within another square, so that its corners shall touch the middle of the sides of the outer one, will be just half as large as the outer square.

Illustrate this fact by folding a paper square as represented by the dotted lines

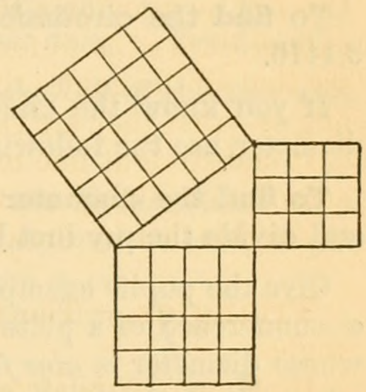
in this figure, so that the corners of the outside square shall meet in the centre of the small one.

3. A square drawn outside of a circle, so that the centre of each side of the square shall touch the circle at four opposite points, will be just twice as large as another square drawn within the same circle so that its corners shall touch four points of the circle.



Illustrate this by drawing a circle circumscribed by a square; and another circle of equal size, with an *enclosed square.*

4. The size of a square drawn on the hypothenuse of a right-angled triangle equals the size of the squares drawn on the other two sides of the triangle.



Illustrate this by drawing squares on the sides of a right-angled triangle; and let the pupils make the illustration on their slates, and count the squares of the base and perpendicular together; then count those of the hypothenuse.

How to Find Areas.—A square whose side measures one inch is called a *square inch.* The *area* of such a square is a square inch. The *area* of a square whose side is two inches is four square inches.

The *area*, in square inches, of any rectangular form may be found by multiplying the number of inches in its length by the number in its breadth.

Find the area of a figure whose sides are 5 inches and 9 inches.

What is the area of a square which measures twelve inches on each side?

144 square inches make one square foot. *Show*, by a diagram, how many square inches there are in three square feet.

Show how many square feet there are in one square yard.

Which is larger, a piece of paper containing *eight square inches*, or a piece of paper *eight inches square?* Represent the difference on the blackboard.

Is one square foot larger than one foot square?

Which is larger, four square feet, or four feet square?

Let pupils represent the difference between them by making diagrams on their slates.

To find the area of a triangle, multiply the length of its base by one-half of its height.

Measuring Circles, etc.—Take a hoop, measure its diameter with a string, place this string on the outside of the hoop and see how many times its length will be required to go around it.

Three times its length will not reach quite around. Nobody knows or can find out exactly how many times further it is around a circle than across it; but the proportion between the circumference and diameter is about 22 to 7, so that about $3\frac{1}{7}$ times the diameter will equal the circumference. But if you wish to be more exact, observe the following rule:

To find the circumference of a circle, multiply its *diameter* by 3.1416.

If you know the circumference of a circle and want to find its diameter, use the following rule:

To find the diameter of a circle, multiply its *circumference* by 7, and divide the product by 22.

Give the pupils examples to apply these rules. Let them find the circumference of a plate whose diameter is *seven inches;* of a wheel whose diameter is *nine feet.* Let them find the diameter of a wheel whose circumference is *twenty-two feet;* of a log whose circumference is *sixteen feet.*

To find the area of a circle, multiply the circumference by *one-half of the radius.*

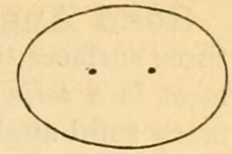
Let the pupils try this with a circle whose *radius* is five feet; with one whose *diameter* is eight feet.

Find the area of a circle by multiplying the diameter by itself, then multiplying this product by $\frac{1}{4}$ of $\frac{22}{7}$, or $\frac{11}{14}$.

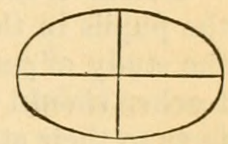
Let the pupils prove these two rules by finding the area of a circle whose diameter is six feet.

Which pie would be larger, one of six inches in diameter, or one of sixteen inches in circumference?

How to Draw an Ellipse.—Drive two pins into a board about three inches apart; fasten the ends of a string about six inches long to these pins, then put a pencil inside the string, stretch it out and move it around, marking a line with the pencil; or make a loop six inches long, place it around the two pins, put the pencil inside of the loop, stretch it out and move it around the pins, marking as it moves. In a room of the shape of an ellipse, a person standing in one focus—a point corresponding to one of the pins—could hear distinctly the whisper of a person at the other focus.



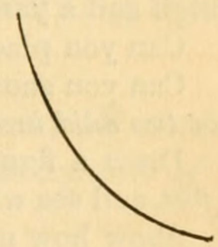
Foci.—The points where the pins are placed are the *foci* of the ellipse. When the foci are near each other, the ellipse is nearly a circle. The orbit or path of the earth around the sun is of the form of an ellipse, and one of the *foci* represents the position of the sun within the orbit. Planets have similar orbits.



Axis.—A line drawn lengthwise of the ellipse, through the foci, is called the *major axis.* A line drawn crosswise of the ellipse through its centre, perpendicular to the major axis, is called the *minor axis.*

To find the area of an ellipse, multiply *one-half* of the two axes together, and that product by 3.1416.

A Cycloid is the path of a point in the circumference of a wheel rolling on a level surface. Take a large spool, stick a pin in one end near the edge, roll the spool slowly on the table and the path of the pin will be in the form of a *cycloid.*



Now, if you could turn the *cycloid* upside down, the inside of the curve would represent the *line of swiftest descent.* If a hill was hollowed out in this shape, sleds would slide down it faster than they could down a hill of any other shape of the same height. This is the line which the eagle makes in his swiftest descent.

Catenary.—Suspend a small chain between two posts, and the curve it forms is called a *catenary.* A loosely hung clothes-line, and the curve in the jumping-rope as it is swung, represent the catenary. If a chain made in the form of the one inside of a watch, and suspended at each end so as to form the catenary, the curve might be turned upside down, and it would stand without falling in. This curve represents the shape of the strongest possible arch for a bridge.

Solids.—Look at the cube. How many faces has it? Height or thickness is the distance between the top and bottom. Breadth is the distance between the left and the right side. Length is the distance between the front and the back. Has the cube thickness or height? Has the cube breadth? Has the cube length? The cube is a *solid.*

A solid has thickness or height, breadth and length. A solid is a magnitude of three dimensions.

Solid Angle.—How many surfaces has this cube? Point to three surfaces that meet in a corner. A corner where three surfaces meet is a *solid angle.* How many solid angles has a cube? How many solid angles has a square prism? How many solid angles has a triangular prism?

Other Facts.—Many interesting facts may be brought before the pupils in these lessons on Form, which will awaken a taste for the study of *geometry*, and prepare them for understanding it. The teacher should watch for favorable opportunities for bringing these facts to their attention, so that they may be presented in answer to, or explanation of, questions asked by the pupils. Sometimes this opportunity may be found by the teacher making statements or asking questions, somewhat like the following:

A man had a window a yard square, which let in too much light; he covered up one-half of it, and still had a square window a yard high and a yard wide. How did he do it? [See *Squares*, page 88.]

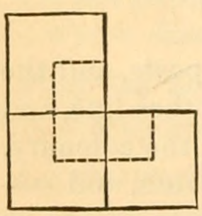
Can you place nine trees in ten rows, with three trees in each row?

Can you show by cutting a turnip which is greater, *two inches solid*, or *two solid inches?*

Draw a figure of *half a foot square*, and another of *half a square foot*, and see which is larger.

Show how many cubes can be made to touch one point.

Show how many *hexagons* you can place around another hexagon, so that each shall touch the central one.



Can the figure formed by these three squares be divided into four equal parts of the same shape?

If you had two balls to be covered, one *two inches* in diameter, the other *six inches* in diameter, how much more leather would it take to cover one than to cover the other?

[Notice how many times the diameter of one is contained in that of the other. The square of this number will show how many times as much it will take to cover the large ball as it will to cover the small one. The diameter of one is *three times* that of the other; the *square of three is nine.* It will take nine times as much.]

Axiom.—A truth that is self-evident, needing no proof; as two lines may be drawn of the same length.

Postulate.—A truth too plain to need proof. A thing so simple that no doubt appears that it can be done; hence we are asked to take it for granted that it can be done.

COLOR.

ADDITIONAL SUGGESTIONS FOR TEACHING COLOR.

The great progress made during the past twenty years in matters pertaining to the nature and relations of colors, and the results of experience with color as a matter of school instruction, show the great importance of giving careful attention to the following points concerning this subject:

First. *Training children to distinguish, match, and name colors, as the means of developing the perception of colors.*

Second. *Ascertaining, by means of this training, which pupils, if any, are color-blind in regard to either red, green, or purple.*

Third. *Teaching children, as advanced lessons, to understand harmony of colors, and to determine what colors appear well when placed together.*

In view of the great importance of giving the lessons on color so that they may not fail to secure the results aimed at; and believing that variety in good modes of presenting any subject tends to increase the interest of pupils and perfect their understanding of it, I deem it important for teachers that other methods for instruction on color be given in addition to those indicated in my *Primary Object Lessons;* and furthermore, I trust that the additional information also presented in this book

will be found interesting and instructive to teachers. Many teachers find it difficult to so combine individual and class-teaching as to secure the best results in the least time. A few hints about giving lessons to large classes will assist in overcoming this difficulty. It is for these reasons, and others stated under the head of *Form*, that the following lessons and statements are given.

Train Pupils to Compare and Name Colors.—Provide pieces of colored papers, or cards, which represent the most prominent colors, as *red*, *yellow*, *blue*, *green*, *purple*, and proceed somewhat as follows:

First. Distribute *red*, *yellow*, and *blue* papers, giving each pupil one color. Then the teacher may hold up one of these colors, and request all the pupils to compare the color shown by the teacher with the one held by themselves, and those who have the same color to hold it up. When all hands are again down, the teacher may hold up another color and require the pupils to proceed in the same way. Continue this exercise until the three colors have been thus compared several times.

Then change the manner by which the pupils show that the color held is like the one held by the teacher, by requesting each pupil who has a like color to stand, holding the color in front of the breast.

Should any pupil stand who has a color differing from the one shown by the teacher, ask that pupil to come in front of the class and compare his color with the one held by the teacher; and let that pupil, also the class, decide whether the two are alike. Proceed in a similar manner with each of the other colors. Should it be discovered that the pupil cannot distinguish each color, tests for color-blindness should be made. [See "Color-Blindness," for methods of testing.]

Second. Distribute in like manner paper or other material of *orange*, *green*, and *purple* colors, and proceed as in the previous exercises.

Third. Distribute the papers as in previous lessons, and ask each pupil to notice what color he has, so that he can remember it when he sees another paper of the same color. Then direct all to put their colors out of sight by folding their arms over them, and the teacher may now hold up a color and request those who have a color like it to stand and show it. Should any one stand who has a different color, call him in front of the class, and let him compare the color that he has with the colors which the teacher holds, and both himself and the class decide, as before, whether the colors are alike. Proceed in a similar manner with the other colors. When the same mistake is repeated by a pupil, test for "color-blindness."

Fourth. When the children know the names of the common colors, the teacher may request all who have a *blue* color to show it; then those who have a *red* color may hold it up, and so on. In each instance let the class correct the mistakes made in showing the wrong color. Lessons may be given in the same manner with each of the common colors.

At the close of each of these exercises call upon pupils to collect the papers—one the *red*, another the *blue*, another the *yellow* ones. Should any mistake be made in collecting the proper color, let the class correct it. These exercises will teach the children to compare colors while seeing them, to compare them by remembering them, and to learn their names.

To distribute these colored papers quickly and in an orderly way, they may be placed upon slates, and one slate passed to each row of seats; or they may be put into envelopes made of stout paper, and as these are passed from pupil to pupil, each one may take out a paper and pass on the envelope. In a similar manner the collections of these papers might be made at the close of the lesson.

Such lessons as have been described here may be given to children during their first year at school. Each lesson should be brief, occupying from ten to fifteen minutes at one time. The first lessons, which especially ought to be short, should embody illustrations by the teacher, calculated to attract the attention of

the pupils. Subsequent lessons, which require more activity on the part of the pupils, may be longer.

Order of Presenting the Lesson.—The order of giving these lessons may be stated briefly, as follows:

First. Showing colors by the teacher; observing, comparing, and matching colors by the pupils.

Second. Pointing out, naming, and otherwise indicating colors, by the pupils, so as to show whether or not they can distinguish them.

Changes in the methods of representing the different colors increase the interest of the children in the lesson; and changes in the modes by which the pupils represent what they know of color, also add interest to these exercises. Avoid, therefore, the use of stereotyped forms of giving the lessons, as these lead to mechanical routine.

Other Methods.—1. Place the chart of colors before the class; call out two pupils; let one take a pointer, the other a color-card, and show it first to the one holding the pointer, then to the class, while the one with the pointer tries to point to the same color on the chart—the class saying "right" when he succeeds. As these two pupils return to their seats, two others may be called on to proceed in a like manner with other colors.

2. This form of giving the lessons may be changed by calling out three pupils at a time; one to use the pointer, another to select the card of the color named by the teacher, and the third to take a colored crayon resembling the color of the selected card; and, while the pupil with the pointer and the one with the card proceed as before, the one with the crayon makes a mark on the blackboard to show the class what color he has selected.

3. For another exercise, let a pupil stand by the table on which a variety of colored objects are placed, and, as one member of the class after another names a color, he is to try to find it and hold it before the class; when "right" or "wrong" will be said by the pupils, as the case may be. When this pupil fails to select the color named promptly, the one who named it may go and find the color, and then take the place at the table, while the first

pupil returns to his seat. During this exercise, the aim of the class will be to name the color which the pupil does not know well enough to select promptly, and thus send him to his seat, that another may take his place at the table.

4. When the pupils have become familiar with the colors, fresh interest may be added to the lessons by calling out different pupils to act the part of the teacher in conducting the exercise.

These different modes of conducting the lessons on color may be changed once in two or three weeks, as the frequency of the lesson and the interest of the pupils seem to require. By these changes the pupils will not become weary of the lessons before learning all that is aimed to be taught by them.

The children should also be encouraged to observe the colors of flowers and other objects at home, and at school to tell the name of the colors thus observed. With young children these color lessons may be given daily, or every other day; while with more advanced primary pupils one lesson each week will suffice. In each case, both the length of the lessons and their frequency should be adapted to the other school exercises.

RESULTS OF MIXTURE OF COLORS.

For the purpose of illustrating the results of the mixture of colors, with a view to explaining why some colors are called *primary*, and others *secondary*, procure pigments, in oil-colors or in water-colors. Select *carmine* for the *red*, *chrome* for the *yellow*, and a light or medium *ultramarine* for the *blue*. Provide, also, a small palette, and two palette-knives. Of course, these pigments do not perfectly represent the red, yellow, and blue as seen in the solar spectrum; yet they furnish good illustrations of those colors.

Since it is of great importance that the methods of giving lessons should be such as to awaken and secure an interested attention on the part of the pupils, care should be taken to give them an opportunity of seeing all that you do to illustrate the lesson. You may commence by placing on the palette a little of the *blue* and of the *yellow* pigments. Spread these out, side by side, with the palette-knives, then request the children to name each of these colors. Next proceed to mix these two colors *together* within view of the class, and ask the pupils to tell what you are doing. When you have produced the *green*, by mixing the *yellow* and the *blue*, ask the pupils:

"What color do you see now on the palette?"
"What colors did I mix together?"
"What color have I made by mixing the *yellow* and the *blue?*"

Then you may write on the blackboard the following:

Mixing yellow and blue pigments will make a green.

Require the class to read this two or three times.

Before illustrating to the pupils how another secondary color may be produced, require them to show that they observed and understood what you did to produce the *green* color. Children become acquainted with colors by seeing them, by comparing them, and by making experiments with them. Therefore, in teaching color to your pupils, it is necessary that you should provide the means for enabling them to learn colors by personal experience with colored substances. You may provide such means by the use of pigments, colored papers, colored crayons, etc. Various exercises may be used for this purpose. Some of these I will describe as illustrative lessons.

Illustrative Exercises.—First. Call a pupil to point out, on a chart of colors, the two colors that were mixed, and require the class to name each as it is pointed out; and at the same time let one pupil select the same colors from colored cards,

or colored papers, and show them to the class; and tell another pupil to select a colored card to represent the color produced by mixing the yellow and blue, and show it to the class; at the same time the pupil with the pointer may point to the green on the chart of colors. Continue this exercise with different pupils until all appear to know the fact that green may be made by mixing yellow and blue pigments.

Second. For your second illustration of secondary colors, place on the palette, side by side, *red* and *yellow*. After the pupils have observed and given the names of these colors, proceed to mix them together, as before, at the same time asking the class to tell what you are doing. When you have produced a good orange, ask the pupils to tell what color you made by mixing red and yellow. Now write on the blackboard:

Mixing red and yellow pigments will make an orange color.

Require the pupils to read it two or three times. Next call out pupils, as before, one to point to the red and yellow on the chart, one to select those two colors from the color-cards, and one to select a card to represent the color that was produced by mixing red and yellow. Continue this exercise as with the one for green.

Third. For a third lesson on mixing colors, take *red* and *blue*, place them on a palette, and proceed as in the previous lessons, showing that these two colors will produce a *purple.*

Fourth. For a fourth lesson on mixing colors, write on the blackboard the result of the illustrations in the three previous lessons:

Mixing red and yellow will make orange.
Mixing red and blue will make purple.
Mixing blue and yellow will make green.

Then call upon three pupils each to select from color-cards, or other colored objects (without telling them the names of the colors), two colors that will produce another; also call upon

three other pupils to select colors that would be produced by mixing each of the two colors held by the first three pupils.

Other Methods.—You can also illustrate the fact that secondary colors may be produced by mixing two primary colors with good colored crayons. You may find it difficult, if not impossible, to get a good *red* crayon, but you can obtain good *yellow* and *blue* crayons.

Take a piece of old white muslin, place it on a slate, or on a piece of smooth board; make a broad line on it, at least half an inch wide, with a *yellow* crayon; then make a broad line with the *blue* crayon across the *yellow*. By mixing these colors a little where they cross each other, a *green* will appear. By making similar lines, crossing each other, with *red* and *yellow* crayons, an *orange* color may be made. By using *red* and *blue* crayons, a *purple* may be made. Similar results may be shown on the blackboard by using colored crayons, but the colors will be less distinct.

A good exercise may be had for ascertaining how well the pupils remember the several facts that have been illustrated with the mixing of colors, by calling upon a pupil to take a red crayon and make two lines on the blackboard; then ask another pupil to take another colored crayon and draw across one of the red lines a color that should be mixed with red to make *orange*. Ask another pupil to take a crayon and draw a line across the other red one, to show what color should be mixed with red to make *purple*. Let other pupils make yellow lines, and show how green and orange are produced. Blue lines may also be made, and the other colors drawn across them to show the formation of green and purple.

Take care to continue each mode of illustration until all the pupils understand it; but also take care to change the form of your illustrations of each fact before the pupils tire of it.

Exercise for a Large Class.—The following method will be found a simple, inexpensive, and efficient means of furnishing additional exercises for illustrating the formation of sec-

ondary colors. This mode is the more valuable because it gives each pupil an opportunity of representing the fact simultaneously:

Procure pieces of colored tissue-paper or some common colored motto-papers, each about three by four inches. Select the best specimens of *red*, *yellow*, and *blue*. Distribute these papers among the pupils, giving to each two different colors. The teacher may now take pieces of *yellow* and of *blue* tissue-paper, place one upon the other, and hold them up toward the window, so that light may be seen through them. Then ask the children who have yellow and blue papers to do the same, and to tell what color they see through the yellow and blue papers. Request the pupils that saw the green color to stand and tell what colors were placed together to make the green.

Proceed in a similar way with *red* and *yellow;* afterward, with *red* and *blue*. Call upon each pupil to look through his colored papers, and to tell what color he sees, also to name the two colors which were placed together to be looked through. Then call upon all who have suitable papers to show how *orange* is made; then call upon others to show how *green* is made; and others, how *purple* is made.

Vary this exercise by asking pupils to show the two colors that will make *green;* then *orange;* then *purple*.

Make Lessons of Your Own.—If you will receive these as illustrative lessons rather than methods to be invariably followed, and—after becoming familiar with their spirit and aim—will then devise other similar exercises having the same end in view, and endeavor to better adapt the lessons to the wants of your own pupils, and especially if your methods of conducting the lessons shall furnish the pupils abundant opportunities for showing that they understand the subject, success will attend your instruction.

REVIEW OF LESSONS ON COLOR.

Naming Colors in Groups.—Write the names of three *reds;* of three *yellows;* of three *blues;* of three *greens;* of three *orange* colors; of three *purples.*

Dark Colors.—Write the names of two *dark reds* on your slate; the names of two *dark yellows;* of two *dark blues;* of a *dark orange;* of a *dark green;* of a *dark purple.*

Show pieces of paper, ribbon, and worsted of each of these colors, and require the pupils to name the color shown.

Light Colors.—Write on your slates the names of two *light reds;* of two *light blues;* of two *light yellows;* of two *light greens;* of two *light purples.* Require the pupils to name each of these colors as it is shown.

Standard Colors.—Write the name of the color that best represents each of the *standard colors*—red, yellow, blue, orange, green, purple. Require the pupils to select each of these standard colors from a group of colors.

Shades of Colors.—Write the name of a *shade* of each of the following colors—*red, yellow, orange, green, blue, purple.* Let the pupils select a shade of each color named.

Tints of Colors.—Write the name of a *tint* of each of the following colors—red, yellow, orange, blue, green, purple, and require the pupils to select each tint from worsteds.

What pigment will produce *orange* when mixed with *yellow?*

What pigment will produce *green* when mixed with *yellow?*

What pigment will produce *purple* when mixed with *blue?*

What pigment must be mixed with *blue* to produce *green?*

What pigment must be mixed with *red* to produce *purple?*

What pigment must be mixed with *red* to produce *orange?*

Write the names of each of these groups on your slate, so as to represent the two colors which must be mixed to produce the third color, thus:

Red
Blue > *Purple.*

Red
Yellow > *Orange.*

STATEMENTS ABOUT COLOR.

FOR THE TEACHER.

Mixture of Colors.—Experiments made with the mixture of pigments of different colors led Sir David Brewster and others to believe that all colors may be divided into two groups—those that cannot be produced by mixing colors, and those that can be produced by the mixture of two or more colors. It was found that an *orange color* could be produced by mixing together *red* and *yellow* pigments; *green*, by mixing *yellow* and *blue* pigments; *purple*, by mixing *red* and *blue* pigments; also, that no mixture of pigments could be made that would produce either *red*, *yellow*, or *blue*. In consequence of these results from the mixture of pigments, the three colors which could not be produced by mixing—*red*, *yellow*, *blue*—were called *primary colors;* and the three colors that could be produced by mixing two of the primary colors were called *secondary colors.*

Newton having shown that the white light of the sun may be separated into the seven prismatic colors—red, orange, yellow, green, blue, indigo, purple—*it was assumed that sunlight may be resolved into the three primary colors*, and that the mixture of colored rays of light would produce the same results as the mixture of pigments. But more recent experiments have shown that the mixture of colored rays of light does not, in all cases, produce the same colors that are obtained when pigments of corresponding colors are mixed. This fact may be easily illustrated by placing a *blue veil* upon a *yellow* surface; or a *yellow veil* upon a *blue* surface, when it will be seen that the color produced is *grayish*, and *not a green*, as when *blue* and *yellow* pigments are mixed. This fact may also be illustrated by drawing a group of fine lines of *blue* upon *yellow* ground, which will also produce a *grayish* color. If fine *red* lines be drawn in a like manner upon a *blue* ground, the surface will appear *purple* at a little distance. If *red* lines be drawn upon a *yellow* surface, an *orange* color will appear.

In explanation of the foregoing facts, the scientists say that *colors* are not mixed by the mixture of pigments; and that *in the case of pigments the mixing takes place upon the palette,* while *with colors of light,* as with the colored veils and the colored lines, *the mixture takes place in the eye.* In many cases, however, the mixture of pigments and the mixture of colors of light lead to results which are nearly identical, as that of *red* and *yellow,* in producing *orange;* and that of *red* and *blue,* in producing *purple.*

It is a common occurrence for manufacturers to produce mixed colors by twisting together differently colored threads, and weaving the yarn thus formed into the fabric, so as to make it, at the distance at which it will usually be seen, appear of the color desired.

Colors are also mixed in the eye by the *persistence of impressions.* You may understand the meaning of this term by recalling the fact that a stick with a coal of fire at one end may be swung around so rapidly as to produce the appearance of a circle of fire. This may be illustrated, also, by painting a red spot upon a black disk, and revolving it rapidly, when a faint red ring will appear. This shows that the impressions of light and color, made upon the retina of the eye, do not cease instantly after the object that produces the impression is removed. It is owing to this fact that the rotating color, and the coal of fire, produce the circular appearance.

The mixture of colors by persistence of impressions may be illustrated by means of rotating disks, and also by color-tops.

Procure circular disks, each about six inches in diameter, made of very thin boards. Let each disk be fastened on one end of an axle, or shaft, which is fitted in two upright standards, so that the disk can be made to revolve rapidly. On one disk paint *red* and *yellow,* in the form of sectors of nearly equal size, and so arranged that each color alternates with the other. Now, by pulling the cord, which is wound around the shaft, the disk is made to revolve rapidly, and the two colors are so blended by the motion that you can distinguish neither the *red* nor *yellow,* but in the place of these you will see *orange,* which is a secondary color.

On another disk paint, in sectors, *red* and *blue,* with the blue

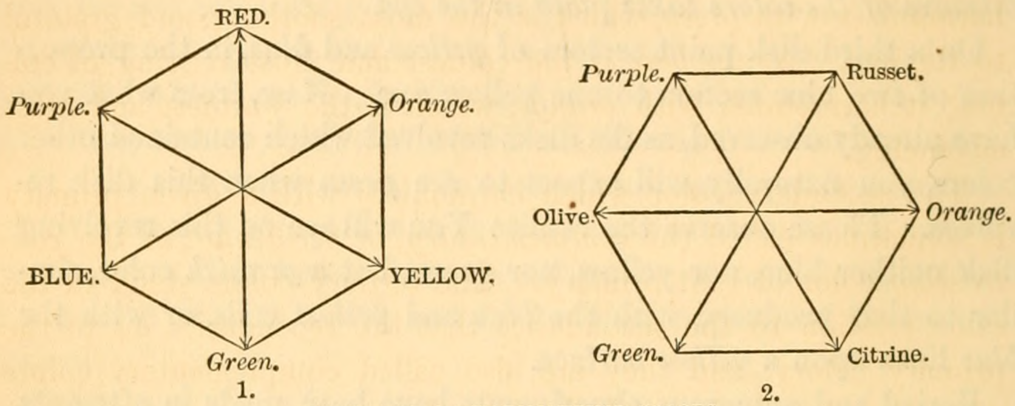
sectors covering about two-thirds of the disk, and the red one-third. By revolving this disk rapidly, these two colors, *red* and *blue*, blend together, and you will see in their place one color, a *purple*, which is another secondary. In both of these cases *the mixture of the colors takes place in the eye.*

On a third disk paint sectors of *yellow* and *blue*, in the proportion of two blue sectors to one yellow one. Now, from what you have already observed, as the disks revolved which contained other colors, you naturally will expect to see *green* when this disk revolves. Please observe the result: You will see on this revolving disk neither blue, nor yellow, nor green, but a *grayish* color, similar to that produced with the *blue* and *yellow* veils, or with the *blue* lines upon a *yellow* surface.

Varied and numerous experiments have been made in attempts to produce *green* by the mixture of colors in the eye, or by the mixture of colored rays of light, but without success; therefore, scientists tell us that *green* may be classed with the primary colors. In reality, all the colors into which sunlight can be resolved by the spectrum may be called primary colors. And white light may be called a mixed color.

As far as pertains to the common experiences of artists, painters, and those who use colors in pigments, or paints, red, yellow, and blue may be regarded as primary colors, and orange, green, and purple as secondary colors. Artists sometimes divide colors into three groups—*primary*, *secondary*, and *tertiary;* the secondary colors being those formed by the mixture of *two of the primaries;* while a tertiary color is one produced by the mixture of *two of the secondary colors.* And, inasmuch as these groups or classes furnish interesting exercises for making the pupils familiar with the different colors, they may be appropriately used in giving color lessons; yet, these classes cannot be regarded as of much importance in matters pertaining to colored rays of light.

HARMONY IN COLORS.



DIAGRAMS OF HARMONIZING COLORS.

The above diagrams will aid in understanding and remembering the harmonizing colors, and the laws that govern them. It will be seen in the first of these diagrams that the name of the *secondary*, produced by the combination of two primary colors, is placed at the angle between the two colors that produce it, and at the angle of the hexagon opposite the primary color with which it harmonizes.

The same plan of arrangement may be seen in the second diagram, showing the two secondaries that produce a tertiary color, and the secondary at the opposite angle, which harmonizes with it.

It may be seen by the preceding diagrams that primary colors harmonize with secondary colors, also that secondary colors harmonize with tertiary colors. It may be added that the shades and tints of these colors harmonize also. But in this connection it should be remembered that as one of the primary colors loses its purity by the mixture of a little of either of the other colors, its complementary must also contain some of the remaining primary. Thus, if the red contains a little yellow, tending toward a scarlet or vermilion, the green, to be truly complementary, should contain more blue, or be a bluish green. If, on the other hand, the red contains blue and tends toward a crimson, the green should contain more yellow, or be a yellowish green.

There is also a principle of contrast existing between colors which harmonize. Thus *yellow*, which is of all colors the nearest to light, harmonizes with *purple*, the darkest of the three regular secondary hues. *Red*, the most positive and exciting of colors, harmonizes with *green*, which is the most soothing and grateful to the eye. Again, *blue* is the coldest and most retiring of colors; it harmonizes with *orange*, which is the warmest and most advancing.

The secondary color which harmonizes with a given primary is sometimes called the *complementary*, or *accidental*, or the *contrasting* color of that primary. The tertiary colors stand in the same relation to the secondaries that the secondaries do to the primary colors; and they are also called complementary colors when they harmonize with the secondary colors.

We have already seen that the combination of those colors which are the constituents of white light are always harmonious, beautiful, and refreshing; and, on the contrary, that those colors which contain only a part of the constituents of white light, as red and yellow, red and blue, or yellow and blue, when placed by the side of each other, are most decidedly inharmonious, and are held as offensive to taste and unrefreshing to the eye. However, this discord may be partially relieved by bringing in a third color which is a harmonic to either of the other two; thus, *red* and *yellow* are disharmonic, but they may be harmonized by the introduction of *green*. These three colors are often seen harmoniously blended in the variegated foliage with which autumn clothes our forests.

Effects by Contrast of Colors.—When two harmonizing colors are placed side by side, *each color not only reflects its own proper hue, but also some of its own complementary rays*, thus mutually enriching each other. When two colors which are inharmonious are placed side by side, the juxtaposition renders them still more inharmonious from the same law of contrast. If a blue is placed by the side of a purple, the blue is apparently darkened in shade, and becomes greenish from the effects of the complementary yellow rays given out by the purple; while the purple is

injured by the reflection of the complementary orange rays from the surface of the blue adjoining it, which inclines the purple toward a russet hue. But these effects are greatly modified by dividing the colors from each other by white.

A color is enriched by contrasting it with a white ground; and weakened by contrasting it with a black ground.

Grays increase the brilliancy of the primary colors when placed in juxtaposition with them. Arrangements of the primaries with *black* are agreeable.

When two tints of the same color are placed together, the light tint will appear still lighter, and the dark tint still darker.

Phenomena of Vision. — Simple experiments may be made with colored wafers, or with small pieces of colored paper or ribbon, illustrating the curious relations of those colors which are complementary to each other.

If a red wafer be placed on a sheet of white paper, and the eyes be steadily directed to it, by-and-by it will appear to be encircled with a fringe of green; now, if the wafer be suddenly removed, there will appear in its place, for a short time, a green spectrum of the form of the wafer. This *ocular spectrum* gradually fades away as the nerves of the eye, which had become fatigued with looking at the color of the wafer, recover their tone. If the wafer be green, the spectrum will appear red; if the wafer be yellow, the spectrum will be purple. Whatever the color of the object, the ocular spectrum will have its harmonic or complementary color.

In a like manner, if we look at the sun when low in the horizon and red, on turning the eyes away there will float before the vision an ocular spectrum of the form of the sun, but of a greenish color.

The reason of these curious effects of color may be explained by the supposition that the part of the retina on which the colored image fell had become fatigued by looking intently at one color, and thereby rendered insensible to it, or unable to receive more rays of that color, so that, when it is removed, the other colors necessary to produce white light, with the color under ob-

servation, immediately unite with it, forming the complementary color seen in the ocular spectrum, thus effecting the restoration of the exhausted portion of the retina to its normal condition.

There is another familiar phenomenon connected with the laws of vision on which the harmony of colors is based. When we examine, for a length of time, a minute object lying on a different colored surface, as a small dark spot on white paper or in a distant field, the object will suddenly disappear. The same result ensues when we strain the eye to perceive a distant object of a small size. After looking at it steadily for some time, the more intently we try to observe it the more sure is it to elude our vision. The sportsman, in endeavoring to follow his game and mark the spot where it alights, is almost certain to be baffled by this physiological law of sight.

Let it be remembered that the point of our best vision is directly in the centre of the retina, and extends over but a small space; that the perception of *form* diminishes rapidly from the centre of the pupil outward in all directions; that around the best point of vision we perceive *red*, *green*, and *purple;* that outside of this circle or belt we perceive only *green* and *purple*, and that beyond this belt we perceive only *blue* or *violet;* and then consider these facts in connection with the laws of harmony of colors, and the phenomena of vision may be more easily understood.

These peculiarities of vision might have proved very embarrassing to us had it not been provided that for clear and distinct sight the eye need not rest long upon the object. A searching motion of the eye, with only a brief dwelling upon the object, gives clearest vision.

COLOR-BLINDNESS.

Color-blindness is a subject about which little was known before the beginning of the present century; and more facts have been discovered in relation to its nature, extent, and dangers within the past thirty years than were previously known concerning it. During the past five years it has assumed great importance in connection with the management of railroads, marine service, manufactories, etc. Both in Europe and in the United States special attention has been given to the detection of color-blindness among railroad employés, with a view to protect travellers from danger and companies from loss by accidents. Not only have railway companies instituted examinations of their engineers, conductors, brakemen, switchmen, flagmen, etc., but several of the State Legislatures have passed laws requiring the railroad companies to make the tests necessary to determine whether or not their employés are defective in distinguishing the colors used as signals; and fines have been fixed for employing any person found to be thus defective in visual power.

This matter has also received special attention from some of the members of the medical profession, who have made extensive examinations to determine the nature and extent of color-blindness. Dr. B. Joy Jeffries, of Boston, has examined instructors and students in colleges and art-schools, and boys in high and grammar schools, during the past two or three years, to the number of more than *ten thousand* persons. In this number he found nearly three hundred who were *red-blind*, seventy-five who were *green-blind*, and over four hundred *totally color-blind.* Dr. Jeffries also examined about *eight thousand* female

teachers, students, and pupils in normal schools, high-schools, and grammar-schools, and among these he found one who was *red-blind*, one who was *green-blind*, and four who were *totally color-blind.* Examinations made of females in Europe show also that the proportion of color-blind females is very small, as compared with that of males. It is probable that the early exercise of the sense of color by girls, and their extensive practice in attention to colors during the experiences of life, develop the color-perception so completely in them as to overcome those deficiencies that are not of a physical nature; while in the case of boys, who naturally give but little attention to color, the color-perception remains but partially developed, and feeble.

Dr. Favre, of France, examined about *six thousand* persons who were candidates for railroad work, and found more than *sixty* red-blind. He also examined seven hundred and seventy-five officers and sailors, among whom he found *seventy-five* color-blind; and *nineteen* of these confounded *red* with *green.* Similar results have been found by examinations made by other persons, in England, Holland, Germany, Norway, Sweden, Austria, Italy, and Switzerland.

As a means of lessening the danger from mistakes in distinguishing *colored signals*, several railroads, among them the elevated roads of New York city, have adopted a system of combined *Signals of Color and Signals of Form*, so that one signal shall verify the other.

Nature of Color-blindness.—The sense of *seeing* appears to possess two distinct powers of perception: these may be called *form-perception*, or the power to perceive different forms; and *color-perception*, or the power to perceive different colors. In some persons the power to perceive colors is absolutely wanting. To such indi-

viduals all colors appear only as different degrees of darkness and lightness. This condition is called *total color-blindness.* In some persons the power to perceive one color—either a *red*, *green*, or *violet*—is wanting. This is known as *partial color-blindness*, and is divided into three kinds, viz.:

Red-blindness—or inability to perceive *red*, mistaking it for *green;* and the seeing of all red colors *much darker than they are;* also confounding reds with grays.

Green-blindness—or inability to perceive *green*, mistaking it for *red;* and the seeing of all green colors *much lighter than they are;* also confounding greens with grays.

Violet-blindness—or inability to perceive *violet*, or bluish purple, mistaking red and orange for purple. This kind is seldom found.

Tests for Color-blindness.—The method of testing for color-blindness now most commonly used, because of its simplicity and certainty, was devised by Professor Holmgren, of Sweden. The materials used are chiefly Berlin worsteds. Colored silks, papers, and other materials may be used; but the worsteds are best, because these can be procured in all possible colors and tones or degrees of color.

The Colors used for this purpose should include excellent samples of *red*, *orange*, *yellow*, *yellow-green*, *pure-green*, *blue-green*, *blue*, *violet*, *purple*, *pink*, *brown*, *gray*, with at least five gradations of each color, from very light to very dark. *Greens* and *grays*, and the *pale-gray browns*, *yellows*, *reds*, and *pinks*, must be well represented.

Method of Testing.—Place the worsteds on a white cotton cloth upon a table in a good light. Lay a skein of the color desired for the test far enough aside not to be confounded with the other worsteds, and require the person to be examined to select other skeins that resemble that, and place them by the side of it. The one examined may be told to select a color like the

test-color, also two or three lighter and one or two darker ones. The individual's ability to perceive color is determined by the manner in which this task is performed.

The principle of the test is to require *the selection of one color from many colors*, and to select it by its resemblance, and not by its name. It is better not to name the colors during the test. The individual examined should depend entirely upon his ability to perceive and distinguish resemblances and differences in colors. Speak of the color laid aside as the *test-color;* the other worsteds may be called the "*colors of confusion*," or simply the *bunch of worsteds.*

First Test.—In testing for color-blindness use the *green test-color* first. Select a *pure green*, one that is about midway between the lightest and darkest grades of the greens. Emerald-green, or the color of Paris-green, will give an idea of the appropriate color for this purpose. Do not select a yellowish green. The person examined should be told to find all the colors that resemble the test-color, including those that are *darker* and those that are *lighter* than the test-color, and to place them by the side of it. Carefully observe what colors are chosen, and the mistakes made, in order to determine whether or not color-blindness exists.

If the person chooses the pale colors, as light grays, with a buff, pink, yellow, brownish, or greenish tint to match the green test-color, or if he chooses a reddish purple or a gray for the same purpose, he may be considered color-blind.

Second Test.—As a second test for color-blindness use a *light purple* as a test-color—one that is midway between the lightest and darkest blue-purple, and inclining toward a *violet*, or bluish purple. If the colors selected to match this by the one who appeared to be color-blind by the first test are all purple, including lighter and darker grades, *he is not fully color-blind.*

Red-blind.—If the person selects a dark blue or a violet to match the *purple test-color*, he is *red-blind.* If he selects dark green, brown, or gray to match a *red test-color*, he is *red-blind.* Take the color known as *vermilion* as the *red test-color.*

Should the person select blue, yellow, or other light colors to

match red, it is evidence of stupidity, or want of developed knowledge of color, and not of red-blindness. The red-blind never select the colors chosen by the green-blind.

Green-blind.—If the person selects a bluish green or a purplish gray to match the *purple test-color*, he is *green-blind.* The green-blind often place a bright violet or a blue with the *green test-color.* If he selects lighter greens or browns to match a *red test-color*, he is *green-blind.* The green-blind never select the colors taken by the red-blind.

Importance of this Subject.*—The great importance of attention to this subject of color-blindness will be apparent when it is remembered that *red*, *green*, and *white* are the colors used on railroads as signals of *danger*, *caution*, and *safety;* and also when it is remembered that success in many of the avocations of life depends upon a normal condition of the perception of color, and the ability to distinguish colors which comes from the exercise of this visual power. By means of proper instruction in school, which shall comprise more experience in *matching colors* than in learning their names, the great majority of cases of defective visual power to perceive colors would be detected and pointed out to the pupils, and warning given as to the impropriety of engaging in any avocation for life in which the ability to perceive and distinguish colors formed a part of the needed qualifications for success.

Colors as Signals.—Colored flags and colored lights are universally used as signals. The colors most commonly employed for this purpose, and the signification of each, are given below:

Red—*a danger-signal.* A *red flag* by day or a *red light* by night is a *signal of danger.* On a railroad, a red flag or a red light swung or waved over the track signifies, "Danger—stop." If a red flag or a red light is stuck up by the side of a railroad it signifies, "Danger on the track ahead." If a red flag is carried unfurled on an engine it signifies, "Another engine on its

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* Those who desire more extended information relative to *color-blindness*, methods of testing for it, etc., are referred to *Color-blindness: its Dangers and its Detection*, by Dr. B. Joy Jeffries (Houghton, Osgood & Co., Boston).

way, following." When a red flag is hoisted at a railway-station it signifies, "Stop at this station."

The Signal Service—weather bureau—displays a *red flag with a black centre* by day, or a red light by night, as the signal that *dangerous weather* or a storm is approaching.

Green—*a caution-signal.* A *green flag* by day or *green light* by night is a signal of *caution.* On a railway, green signifies, "Travel slowly." It is more a signal of safety than of danger.

White—*a safety-signal.* A *white flag* by day or a *white light* by night is *a signal of safety.* To an engineer or conductor of a railway-train it means, "All right—go ahead."

The white flag is a token of peace. In war it signifies a desire to stop hostilities, and a request for a conference. It is called a *flag of truce.*

Black.—A *black flag* on a ship denotes *piracy.* In war it is sometimes hoisted to signify that no quarter will be given or taken; it denotes death to all.

Yellow.—A *yellow flag* in a harbor denotes *quarantine*—*a hospital.* It indicates the surgeon's head-quarters in the army.

Marine Signals.—By a general law of nations lights must be carried from sunset to sunrise, to indicate *the position and course* of a ship at night. For this purpose the colors chosen are a bright *white light* carried at the head of the foremast, a *green light* suspended on the starboard (right) side, and a *red light* on the port (left) side. These lights are so placed that when all of them can be seen the vessel is directly ahead, and its direction can be determined by observing on which side the red and green lights appear.

Colors as Emblems.—Every passion and emotion of the mind has its appropriate tint in colors. Color influences anger, deepens sadness, warms love, and brightens joy.

Black is an emblem of *sorrow* and *mourning.*

White is an emblem of *innocence, peace, purity.*

Red signifies *defiance.* It is an emblem of war. It stimulates

courage, anger, fierceness. It excites the anger of the turkey, and provokes the madness of the bull.

Blue is an emblem of *faith.* The blue sky above reminds of the realms beyond, and enkindles faith in God's promises.

Yellow is symbolic of *joy.* The sensible effects of yellow are gay and enlivening. The yellow harvest crowns the year, and gives joy to the husbandman.

Orange is symbolic of *richness.*

Green is symbolic of *youth* and *vigor.* It is an emblem of *hope.*

Purple is an emblem of *royalty.* The sensible effects of purple are those of grandeur, stateliness, dignity.

Brown in its effects is *sedate, stable.*

Gray indicates *humility.*

Effects of Color on Complexion.—If the complexion is that of a blonde, *sky-blue*, the complement of a pale orange, enriches it.

Green tends to add a ruddy tint to a light complexion; but it changes the orange hue of a brunette to a brick-red color.

Yellow and **Orange** produce a pleasing effect on the brunette complexion.

White has a good effect upon light complexions; but dark complexions appear worse by its strong contrast.

Black makes the complexion appear lighter.

The prevailing color of the complexion may be either heightened or lowered by the dress worn. It is *heightened* by white drapery, and *lowered* by black drapery. Green drapery heightens a rosy complexion, and adds more red to the orange complexion.

A light-blue drapery heightens a pale orange or blonde complexion.

A deep-red drapery lowers the tint of a rosy complexion; and a *deep orange* lowers the tint of an orange complexion.

A delicate green is favorable to all fair complexions that are deficient in rose.

ADVANCED LESSONS ON COLOR.

By carefully observing the effects produced upon the eyes, while looking steadily at different colors, it will be noticed that the sensation becomes unpleasant when the eyes are directed to a single color for a long time; also that relief is experienced when another color is placed before them. It will be found that white light is more agreeable to the eye, in its normal condition, than any colored light. And in order to afford agreeable sensations, there must be white light (which contains all the colors of the spectrum mixed together), or there must be present two colors which would produce white if mixed together.

Complementary Colors *are those two colors which, united, contain the three primary colors; or which, when mixed, would produce a whitish color.*

When pigments are used in the mixing of colors, the following pairs of colors are the complements of each other: *red* and *green; yellow* and *purple; blue* and *orange.*

It will be observed that in each pair one of the colors named contains the two primary colors which, united with the other color of the pair, furnish the three primary colors necessary to produce white.

It has been ascertained by numerous experiments in mixing colored rays of light, colored lines, and other means by which the colors are mixed in the eye, that each color in the following list complements the one opposite in the other column:

Red complements	. . . .	*Bluish green.*
Orange "	. . . .	*Turquoise blue.*
Yellow "	. . . .	*Ultramarine blue.*
Green "	. . . .	*Purplish red.*
Violet "	. . . .	*Yellowish green.*

Similar modifications, from dark to light, and pale, may be

made in the colors of each of these pairs, and still they will complement each other. If the red be changed from a *carmine* to a *scarlet*, the complementary green will contain more *blue*. Even a slight change in the hue of one color renders it necessary that a considerable change be made in the hue of its complementary color.

How to find Complementary Colors. — Experiments made with *blue* lines upon a yellow surface, with a *blue* veil on a yellow surface, also with colors on revolving disks, and by mixing pigments, will indicate, by the production of *a grayish white color*, colors that complement each other. But the following are more simple experiments that may be easily made for the purpose of determining what color is a complement of any given color. Take colored wafers, or pieces of colored paper, silk, or some other material, place a single one upon a black surface in a strong light, and look at it steadily for a few seconds, then suddenly push away the colored object, keeping the eye fixed upon the spot, and the complement of the color thus looked at will appear in its place. If the object looked at be *red*, the after-image will be *bluish green;* if *orange*, the image will be *blue;* if *yellow*, the image will be *dark blue* or *indigo;* if *green*, the image will be *purplish red;* if *violet*, the image will be *yellowish green.*

Colors which are complements of each other will harmonize when placed together. In order to determine whether a color will harmonize, or appear well if placed with another, we may ascertain whether it is a complement of that color by a process similar to that described above; or we must decide whether the two colors contain those that produce white.

Harmony of Colors.—From what has been said concerning complementary colors, it will be readily seen how we may ascertain which are harmonic colors, as these are governed by the same laws as the complementary colors. It will also appear that a true harmony of colors is based upon something more certain and permanent than the caprice of fashion, or that which is commonly called "taste," with its liability to become perverted.

The laws of harmony of colors ever remain the same, yet the

indefinite modifications of colors allow a corresponding variety in their harmonious arrangements.*

Harmony of colors may be properly classed with useful knowledge, since it enters into works of art, manufactures, decorations of dwellings, the selection and arrangement of materials of dress, and into various matters of daily life. It is also both useful and interesting as a matter of instruction. But to be most practically useful, the instruction should consist chiefly of exercises for training the pupils to discriminate *when* the given colors harmonize, rather than of those requiring the mere memory of facts as to *which* colors do appear well together. These lessons will be more generally useful to girls than to boys; and girls will doubtless take the most interest in them.

It now remains to describe how lessons in harmony of colors may be given.

Materials for Lessons.—For illustrating harmony of colors, procure a variety of colored papers, pieces of silk, worsteds, etc., of different shades and hues, as dark red, purplish red, light red, vermilion, orange, yellow, yellowish green, green, bluish green, blue, turquoise blue, ultramarine, purple, light purple, violet, light violet, brown, russet, citrine, olive, gray, black, white, etc.

The colored papers may be cut in squares of two sizes—two inches and one inch. Place a one-inch *red* square on a two-inch *green* one, and a one-inch *green* square on a two-inch *red* one. Attach the smaller square to the centre of the larger one with gum, so as to allow the color of the larger square to show around the smaller one. Arrange other pairs of complementary colors in the same way. Also, arrange pairs of colors that are *not complementary* in a similar manner.

* Those who desire to obtain further information upon this subject, and upon the Science of Colors as applied to arts and manufactures, may find recent authority in *The Theory of Color*, by Dr. Von Bezold, translated by S. R. Koehler, with illustrations (L. Prang & Co., Boston).

LESSONS IN HARMONY OF COLORS.

THE following lessons are given as illustrations of methods that may be used, but not to be copied, or literally followed by the teacher:

I.

Object.—To lead the pupil to simple perceptions of harmony and of discord in colors.

Place before the pupils, or, better still, in the hands of each one, a pair of complementary colors, prepared as before described, and request them to notice whether the two colors thus represented look well together.

Then let the pupils select the same colors from the worsteds or pieces of silk, place them together, and notice their appearance.

Change the pair of colors, so that each pupil shall hold a different pair. Let them select like colors, place them together, and observe the effect.

When the pupils have thus observed pairs of *red* and *green*, *blue* and *orange*, *yellow* and *purple*, place before them pairs of colors that are not harmonic, as *red* and *orange*, *yellow* and *orange*, *blue* and *green*, *yellow* and *green*, and lead them to notice whether the colors of these pairs look well.

Next let the pupils take one of the colors of the non-harmonic pairs, and try to find another color that will look well with it.

Talk about colors for a dress. Ask whether blue ribbon would look well on a green dress; whether yellow would look well on a pink dress; whether red would look well on a green dress, etc.

Continue exercises in arranging colors that look well together until the pupils understand that some colors please the eye, while others offend it.

If it be found that false notions as to which colors may be grouped together are entertained by the pupils, these should be corrected.

II.

Object.—To furnish additional exercise in the harmony of colors.

Place before the pupils colored papers, silks, worsteds, etc., and request each to form pairs of colors that look well. Should a pupil violate the law of harmony in the arrangement of these pairs, call her attention to it; and if she cannot correct it, let the class tell what is wrong, and what color to substitute for one of them.

Let pupils select colors that please them best, and the class decide whether the colors are harmonic.

Place before the pupils pairs of non-harmonic colors, and request the pupils to tell what changes must be made to produce a pair of harmonic colors.

Request the pupils to arrange flowers in a bouquet so that the principal colors shall be harmonic. Place complementary colors side by side, as blue with orange, yellow with purple, red with green leaves; and use white to separate colors which do not harmonize. Add a variety of similar exercises, until the pupils appear to understand when colors are harmonic, and why some colors do not please the sense of sight.

After lessons for observing colors that look well together, arrange other pairs of colored squares, as follows: *red* and *orange; yellow* and *orange; blue* and *green; yellow* and *green; blue* and *purple; red* and *purple.* Show these groups of colors to the pupils, and ask them to decide whether these look as well as those of the other groups. Then place squares of *red* and *green*, and of *red* and *orange*, before the pupils, and let them tell which pair appears better. Make similar comparisons with other colors, so as to afford abundant exercise in discriminating colors that harmonize from those that do not.

Care should be taken to so conduct all of these lessons on harmony of colors that *the pupils will be required to observe* the effect of each pair of colors, and to decide for themselves whether the colors appear well together.

III.

Object.—To teach the names of prominent colors that harmonize.

Request the pupils to name colors that harmonize in the pairs of harmonic colors shown them. Request them also to arrange colors in harmonic pairs, and to tell what colors they thus place together.

Request them to point out and name, from the chart, two colors that harmonize.

The teacher may name a color, and a pupil name one to harmonize with it.

One pupil may name a color, the next pupil one to harmonize with it, and so on around the class.

The teacher may name five colors for pupils to write on their slates, and require the pupils to write with each color the name of one that will harmonize with it.

Let pupils select colors, and others match them with harmonic colors, and name each color.

Give lessons in which special attention is directed to ascertaining what color harmonizes with a given color. The method already mentioned under the head of "Complementary Colors"—that of placing the given color upon a black surface in a strong light, etc.—may be used.

IV.

Object.—To lead the pupils to notice harmony between *secondary* and *tertiary* colors.

Place before the pupils various objects, cards, etc., representing purple, orange, green, russet, citrine, olive, etc., and request the pupils to select pairs of colors that harmonize. The names of these pairs may be written on the blackboard as they are selected by the pupils, thus—

Purple,	*Green,*	*Orange,*
Citrine.	*Russet.*	*Olive.*

Request one pupil to select and name a secondary color, another one to select its harmonic color, and name it.

V.

Object. — To lead pupils to observe the principles of harmony of colors in dress and decorations of rooms, etc.

Provide articles — as shawls, capes, etc. — of different colors. These may be made of colored paper if the desired colors cannot be found in garments at hand.

Select a child with a pink dress, and place a blue cape on it, and request the pupils to notice the effect.

Place a green cape on the same child, and let the pupils tell which looks better.

Make similar experiments with dresses of other colors, until the pupils readily understand what colors may be used together in articles of dress.

Lead them to notice colors of carpets, and to tell what colors would look well for furniture-covering, wall-paper, etc., in the same room, with the given color.

VI.

Object.—To lead pupils to observe the effect of black and white grounds upon colors, etc.

Interesting experiments may be made which will lead the pupils to observe how colors are affected by white, black, or other colors. Place red, blue, green, purple, orange, yellow, etc., separately upon white paper, and upon a black surface, and upon surfaces of other colors, and let the pupils notice the differences in their brightness and fulness when seen in these different positions.

Call out two girls, each with dark hair and dark complexion. Place on one child a light-blue cape or shawl, on the other a red or pink one. Request the pupils to tell which color is most becoming to these girls. Place other colors upon these girls, and let the children tell whether they look well or not.

Call out girls with light hair and light complexion, and proceed in a similar manner, leading the children to determine which colors appear best on them.

During all the lessons on harmony of color, as well as in the previous lessons, you should bear in mind that your chief purpose is to train the pupils to distinguish the differences, resemblances, and relations of color, and that you can succeed in doing this only by exercises that will cause the pupils to use their own powers of observation.

In conclusion, let me add that during every lesson on color great care should be taken to give the pupils abundant *experience with colors;* and in all your efforts to teach them the important facts in relation to this subject, let your chief reliance for success be placed upon that which you induce the child to perceive and do for itself.

Name of Color.	Name of Pigment or Paint that will produce it.
Red	Carmine, madder lake, Chinese vermilion.
Orange	Red-lead, cadmium yellow.
Yellow	Chrome yellow, gamboge.
Green	Paris green, emerald green.
Blue	Turquoise blue, Prussian blue.
Dark blue	Ultramarine, indigo.
Violet	Mix Chinese vermilion, turquoise blue, and white, using most of the blue.
Purple	Mix carmine and ultramarine, using most of the red.

Each color may be made lighter by mixing pure *white* with it.

Imperfect representations of some of the primary and secondary colors may be produced by a solution of chemicals,—interesting experiments with such solutions may be shown by any druggist,—but the mixture of two primary colors, thus produced, will not form a corresponding secondary color, as with the mixture of paints.

PROPERTIES OF OBJECTS.

[Supplementary to Lessons on Qualities in Primary Object Lessons.]

THE lessons on Qualities in *Primary Object Lessons* [pages 345–364] have for their chief purpose the development of the several senses of young pupils, by training them to discover given qualities in different objects, and thereby teaching them habits of careful observation. Those lessons on qualities were also intended to prepare the pupils for the succeeding Lessons on Objects [pages 365–406], through which they learn to discover what qualities belong to given objects, and which of those qualities make the objects most useful. The lessons on objects were designed further to teach that objects are adapted to their respective uses because they possess certain qualities, and also to show how those qualities fit the object for the purpose for which it is commonly used.

It is intended by these lessons on the *Properties of Objects* to teach the pupils to distinguish those other qualities which, though less palpable, enable us to determine what *substances* compose the different objects, and thereby guide the learner to a more comprehensive and practical knowledge of objects and their uses. It is understood that the pupils will have become familiar with the common qualities of objects, by means of previous lessons, before the following lessons are given; therefore, the teacher may use the knowledge thereby gained to teach the pupils additional facts about objects.

LESSONS TO DEVELOP THE IDEA OF SUBSTANCES.

Teacher's Introduction.—To-day I shall try to teach you something new about objects. You know that some objects are brittle, others tough, elastic, combustible, transparent, absorbent, fusible, soluble, ductile, etc., and that the objects are used to make different things because they possess some of these qualities. You also know that some things are made of wood, as chairs, tables, doors, and various parts of houses; you know that some things are made of iron, lead, silver, steel, as stoves, nails, shovels, hammers, pipe, spoons, forks, knives, and other tools; that some things are made of leather, as shoes, boots, harnesses, saddles, trunks; other things are made of stone and brick, as slates, houses, walls, walks, bridges. Now, if you will think about these objects, you will remember that wood, iron, leather, and stone differ from each other very much. Some of them are combustible, while others are not; some are fusible, while others are not; but these are not the differences which I wish you to learn now.

Each of these objects of which things are made—as wood, iron, lead, stone, leather—is called a *substance.* I will write the word on the blackboard, and you may name each letter as I make it:

s u b s t a n c e.

What did I call this word?

Pupils. Substance.

T. William may spell the word, and name some substance.

Some substances are hard, like stone, iron, silver; some are soft, like cotton, silk, fur; some are heavy, like lead, silver, stone; some are light, like feathers, sponge, cork. Thus you see that substances have many different qualities; that qualities do not make substances, but that substances possess qualities. Qualities belong to substances. A *substance* is a thing which can be perceived, or used, or made into something to be used. It is the

material of which anything is made. Now you may tell me what a substance is.

Pupils. A substance is that of which anything can be made. A substance is something that we can perceive by a sense.

Teacher. You may name the substances that you can think of, and I will write the names on the blackboard.

P. Wood, coal, ashes, sand, stone, bark, clay, brick, slate, iron, lead, silver, gold, water, cork, cotton, wool, silk, fur, leather, bone, ivory, wheat, corn, turnip, apple, peach, glass, ice, milk, etc.

T. Now, if you will look at the names of these substances, and think about them, you will notice that they are not all alike. I will try in our next lesson to teach you to distinguish different kinds of substances, and to arrange them in groups or classes.

CLASSES AND KINDS OF SUBSTANCES.

Second Lesson.—*T.* You have already learned that all substances are not alike; now I will try to teach you about the kinds and classes of substances, and how to distinguish each class. First, I will give you another word which means about the same as substance; that word is **matter.** When I use the word *matter*, you may know that I mean either all *kinds of substances*, or that of which anything is composed. Thus, all animals are matter; all flowers, plants, and trees are matter; all sand, stone, iron, silver, and gold are matter. By observing these various substances you will discover that all matter is not alike; it may be divided into classes and kinds.

One class of matter, such as we see in animals, is arranged into parts for specific uses, as eyes, teeth, nails, hair, feathers, skin, flesh, blood, bones, etc. Another class of matter, such as we see in plants, is also arranged into different parts for other uses, as roots, bark, leaves, sap, wood, fruit, flowers, etc.

Another kind of matter has no parts for a specific use, as stone, sand, clay, iron, lead, ice, water, etc.

Now, we call all matter that is arranged into parts for specific uses—as parts of animals and plants—**organized matter**; and we call all matter that has no part of it arranged or fitted for any

particular use, **unorganized matter.** To show me whether you understand what these terms mean, you may name things that belong to the *organized matter*.

Pupils. Wool, feathers, hair, teeth, eyes, skin, wood, sap, bark, leaves, fruit, etc.

Teacher. Now you may name things that belong to the *unorganized matter*.

P. Rocks, clay, slate, sand, ice, iron, lead, tin, silver, water, etc.

Animals.—*T.* Very good. Now you can easily learn to distinguish the different classes of substances. You know that some things have *life* and *feeling*, and *breathe*, and *take food*, and *move about* by their own power. Such things we call *Animals.* Who will tell me what animals have?

P. Animals have *life* and *feeling.*

T. What can animals do?

P. Animals can *breathe*, *take food*, and *move.*

T. I will write it on the blackboard, and you may copy it:

An animal has life and feeling; it takes food, and can move itself.

Animal Substances.—Sometimes we see parts of an animal—something that once belonged to an animal—such as horn, hair, fur, feathers, skin, glue, tallow, bone, wool, etc.; these things are called *animal substances. An animal substance is something that once formed a part of an animal.*

I will now write some words on the blackboard, and you may tell me which are names of animals, and which are names of animal substances. [Teacher writes three columns; two of animals, and one of animal substances.]

1.	2.	3.
Cat,	Fur,	Eagle,
Dog,	Hair,	Fish,
Cow,	Wool,	Fly,
Sheep,	Horn,	Ant,
Hen,	Bone,	Bug,
Duck.	Feathers.	Snake.

Teacher. Now, which words are names of animals?

Pupils. Those in the first and third columns.

T. What do the words in the second column represent?

P. Animal substances.

T. Now let us examine these words, and see if each of those in the first and third columns represents something that has *life* and *feeling.*

P. I think all of them do represent something having life and feeling.

T. Well, does each word represent something that *takes food* or *eats?*

P. Yes.

T. Does each word represent something that can *move itself?*

P. Yes.

T. Then all of those words represent animals. Now let us examine the words in the second column. Here is a piece of feather; did this ever form a part of an animal?

P. Yes; a part of a bird.

T. Can you say that fur, hair, wool, horn, and bone once formed parts of animals?

P. Yes.

T. Then you are correct. All the words in the second column are names of animal substances. Now you may take your slates and write the names of *ten animals*, and the names of *ten animal substances.*

Third Lesson.—*T.* Some things, I told you, have life and feeling. There are other things that have another kind of life, but which have *no feeling.* Some things, you know, have the power of motion. There are other things which have no power of motion. We will now talk about those things which have life, but not the power of motion.

Plants. — Here, in this pot of earth, is a flower; it is also called a plant. It grows, sends out leaves, buds, and blossoms. But if you should remove it from the earth, or neglect for a long time to water it, the plant would die. If a plant can live and die, it must possess life. It has what we call *plant-life.*

Now, if you should pinch a plant with your fingers, or cut it with a knife, do you think the plant would feel pain?

Pupils. No. Plants have no feeling.

Teacher. Certainly they have not such feeling as you and other animals have, although they may be killed.

The plant *takes food* from the moist earth by means of its fine thread-like roots. Water, by remaining in the soil, dissolves some of its nourishment, and this moisture is taken up by the fine roots of the plant or tree, and carried through the little pores to the stem, and branches, and leaves, and blossoms. The water thus taken up is what constitutes the juice or sap of the tree. This sap flows through all parts of the plant very much as the blood flows through all parts of our bodies. The plant also takes food from the air by means of its leaves, which are filled with thousands of very little holes, called pores. It seems to breathe through the pores in its leaves, and by means of these it also takes food from the air.

Thus you see that *plants live, take food, and breathe;* but *plants have no feeling, nor the power of moving from place to place.* Their life is not the same as that of animals; they do not take food in the same way as animals do; they do not breathe as animals breathe.

All trees, shrubs, flowers, grasses, vines, and mosses are plants. They are also sometimes called vegetables. Vegetables *have life;* they *take food;* they grow in or from the earth; but they have *no feeling,* and *no power of moving themselves.*

Now listen while I read to you something which I found about vegetables and animals in a very interesting book:*

"Only observe the air and food which a tree requires to keep it alive. Its roots suck up the juices which they find in the earth; and by some wonderful power which the great Creator has put in a tree, these juices are made to run up the stem. They run up partly under the bark, but mostly through the cells or holes in the fresh wood that was made during the former year; and these juices run up the stem, something in the way that water runs up the sides of a piece of sugar; only in the trees these juices do not stop, but go on

* *The Observing Eye.*

till they reach the leaves. Now every leaf is full of innumerable little holes, through which air rushes in and mixes with the drawn-up juices; and as every leaf is made up of a top skin and of an under skin, with fine fibres running between them, the fresh sap runs along the top part of the leaf, and then passes to the under-side of the leaf. During this passage through the leaf, the air changes the quality of the pumped-up juices.

"Sometimes the air prepares the sap to become sweet, sometimes sour or bitter; sometimes it prepares it to turn to a clear gum, sometimes to a thick juice like tar, just according to the laws which the wise Creator has seen it good to establish. As soon as the air has made this change, the sap flows back into the tree, and going down under the bark, it forms a band of new wood, and likewise nourishes the woody fibre of the great trunk.

"Animals have no roots by which to gather up the nourishment they require. Their food is received by a mouth, and passes down into a cavity called the stomach, where it is melted or dissolved. The juices drawn out of the received food are then carried all over the animal by innumerable little tubes, called arteries and veins. Yet air must always mix with these juices, or the animal will die. Some creatures draw the air into their blood through little holes in their sides—flies do this; others draw the air in by gills—such as fishes; others draw air down into the chest by breathing. In the chest the air meets with the new juices, and turns them to a bright red. This bright-red blood keeps the bodies of all back-boned animals warm, and makes them grow.

"So far we have seen that both vegetables and animals want two things: they want food and air. What, then, is the difference between a plant and an animal? The great difference is that vegetables always absorb, or take up their food by the roots, or outside of their bodies; while animals always absorb or take up the juices of their food from cavities in the inside of their bodies. And these two modes of support make an important difference in vegetable and animal life. Vegetables become fastened down in one place, that their roots may absorb the moisture around them; while animals carrying their food with them are generally left at liberty to move about. Then, again, vegetables have no feeling and no wills; while animals feel pain, and not only move about from place to place, but have strong wills."

Teacher. Now who will tell me what a plant or vegetable is?

Pupils. A plant or vegetable is something that has life, takes food, but has no feeling, and cannot move itself.

Vegetable Substances.—Things that once formed a part of a tree or vegetable are called vegetable substances—as wood, bark, nuts, fruit, flax, cotton, tea, coffee, sugar, grains, straw, flowers, etc.

Fourth Lesson.—Review. The teacher may now mention various articles—as corn, wheat, sheep, hens, flowers, vines, pigeons, hawks, flour, wool, feathers, starch, tea, sugar, hair, cows, etc.—and request the children, as each is named, to tell whether it is an animal or vegetable, an animal substance or a vegetable substance.

Afterward the children should be requested to mention several animals, while the teacher writes their names upon the blackboard; then several vegetables, in the same manner; also to mention animal substances and vegetable substances in a similar manner, and the teacher to write the names upon the blackboard.

The teacher may extend this subject, when the age and attainments of the pupils make it appropriate, to some classifications of vegetable and animal substances. This may be commenced by requesting the pupils to mention substances for each column, while the teacher writes the words in their proper places, after head-lines have been written on the blackboard as follows, viz.:

VEGETABLE SUBSTANCES USED

For Food.	For Clothing.	For Other Purposes.
Corn, beans,	Cotton,	Cotton, flax, hemp, and straw for *paper*.
Pease, wheat,	Flax,	Wood for *houses*, *furniture*, *carriages*, *fuel*, *utensils*, etc.
Potatoes,	Hemp,	Indigo, logwood, madder, saffron, and various barks, for *coloring*.
Beets,	India-rubber,	Camphor and other gums, castor and other oils, for *medicine*.
Onions,	Palm-leaves,	
Cabbage, turnips,	Straw.	
Apples, peaches,		
Oranges, grapes,		
Berries, nuts,		
Sugar.		

The same plan may be pursued with animal substances, writing on the blackboard as follows, viz.:

ANIMAL SUBSTANCES USED

For Food.	For Clothing.	For Other Purposes.
Beef, pork,	Wool,	Leather for *harnesses*, *shoes*, *bookbinding*, *trunks*.
Mutton, fish,	Fur,	Horn for *buttons*, *knife-handles*, *combs*.
Veal, lamb,	Silk,	Bone for *buttons*, *handles*.
Turkey, chicken,	Leather,	Ivory for *keys of pianos*.
Eggs, butter,	Hair.	
Cheese, milk.		

Fifth Lesson.—Mineral Substances. *Teacher.* We have been talking about things that have life, and those that once formed a part of something that had life. Now, can any of the children tell me whether they ever saw anything that has no life, and that is not a part of any animal or vegetable?

Pupils. Yes; a stone, a piece of iron, salt, silver, glass, gold, sand, slate-pencil, copper, chalk, coal, etc.

T. Now let us see how many *kinds of substances* we have found: those that have life and feeling and self-motion, as *animals;* those that have life, but no feeling nor self-motion, as *vegetables;* and those that have neither life, nor feeling, nor motion; these are called *minerals.* Now write on your slates what I tell you about these three classes of substances.

Mineral.—A *mineral* has *no* life, *no* feeling, *no* self-motion, and *does not* take food. A mineral is obtained from the earth, and is a part of the earth. A *mineral* has no parts arranged for any particular purpose, as roots, sap, leaves, feet, hands, etc. It has no organs. A mineral is *not an organized substance.*

Vegetable.—A *vegetable* has life; it grows in or from the earth; it takes food from the earth. Its food is unorganized matter, or a mineral substance. A *vegetable* has roots, trunk, branches, leaves, bark, sap, each designed for a special purpose. These are its organs. It is called an *organized substance.*

Animal.—An *animal* has life; it moves about the earth; it takes for food organized matter, either vegetable or animal substances.

An *animal* has organs for seeing, for breathing, for eating, for hearing, for feeling, and for moving about. It is called an *organized being.*

Now tell me what both the vegetable and animal have. Tell me what both the vegetable and animal do. Tell me what the animal does that the vegetable and mineral cannot do.

The teacher may now write on the blackboard the following head-lines, also the names of substances, as the pupils tell in which column the names mentioned should be written:

Mineral.	Vegetable.	Animal.
Stone, iron,	Grass, flowers,	Cat, horse,
Lead, water,	Coffee, tea,	Fly, bird,
Ice, brick,	Sugar, starch,	Cow, moth,
Salt, coal,	Wheat, potatoes,	Snail, fish,
Slate, chalk.	Apples, nuts.	Ant, boy.

Teacher. You have already learned that there are *three kinds* of substances: *minerals, vegetables,* and *animals;* that animals and vegetables have life, and that minerals have no life. Now can you tell me what animals do to sustain life?

Pupils. They take food.

T. Which do they eat—animals, vegetables, or minerals?

P. Some animals eat other animals, and some eat vegetables.

T. Can you tell what animals eat other animals, and what animals eat vegetables.

P. The cat eats mice and birds; the dog will eat the flesh of other animals; the lion, tiger, hawk, and eagle eat other animals. The cow, horse, sheep, goat, hen, goose, and many birds eat vegetable substances.

T. Can you name any animal that takes minerals for its food?

P. I cannot.

T. Animals cannot live on mineral substances alone. Some animals must take vegetable food, and thus produce animal food of their own flesh. Some animals eat the flesh of other animals; but animals could not live without vegetables to change mineral substances into conditions suitable for food. Thus you see that animals depend on vegetable life for their food, and vegetables depend on minerals for their food.

The rain, sunlight, heat, and frosts soften the rocks, and cause them to crumble into fine earth, or soil. The moisture, warmth, air, and sunlight cause the plants to grow. By some wonderful process they obtain food from the fine soil at their roots, and from the air around their leaves, and thus change their food into a new substance that we call *vegetable.* This new substance, in turn, becomes food for animals, and it is again changed into other substances that form the flesh and bones of the animal. Thus you may see how each kind of substance depends upon each of the other kinds. The plants take the mineral substances of the earth and air, and change them into vegetable substances; the animals take the vegetable substances, and change them into animal substances.

Minerals are inorganic matter; vegetables and animals are organic matter. Minerals furnish the materials for vegetables; vegetables furnish the materials for animals. Animal life depends upon vegetable life for support; vegetable life depends upon minerals for support. Plants produce; animals consume. Without plants, animals would perish.

SUBSTANCES.

MATERIALS FOR ADVANCED LESSONS ON OBJECTS.

MODEL lessons are apt to become formal; do not try, therefore, to commence all lessons in the same manner. Sometimes begin by telling the pupils something about the subject; sometimes by requesting *them* to tell something about it; sometimes by questions. Surprises are frequently more effective in arresting attention than the best of prepared introductions. Try to make the lessons real and life-like to the children. At times let them tell what they see in the object, or what they know about it; at other appropriate times tell them new facts, when they most need them. Never tell them facts for the sake of the telling, but to meet a pressing want on the part of the pupils, which they cannot themselves supply by ordinary efforts.

The aim in these pages is to supply a sufficient amount of information on a variety of subjects, with notes of lessons and suggestive exercises, to furnish teachers with abundant materials for interesting and profitable object-lessons.

Where lessons are written out they are intended chiefly to illustrate the general manner of giving them. The *notes of lessons* are furnished to point out the important facts, and to indicate an orderly presentation of them; while the information *for lessons* on other subjects is designed to furnish accessible matter necessary for arranging new lessons.

No one must suppose for a moment that the range of subjects and lessons here presented exhausts the treasures of this interesting field; they are barely first steps into regions almost boundless in the extent and variety of materials suitable for object-teaching; and they aim to point the way in which teachers may lead their pupils to a practical study of the world around them.

In conducting lessons on objects with these substances, the pupils should be led to *give special attention to those qualities and properties which constitute their chief value*, and which cause them to be used for their respective purposes. Teachers should prepare for giving the lesson by selecting the subject and deciding which are the important facts to be taught. The *substance* about which instruction is to be given, and other materials for illustrating the lesson, should be provided beforehand. On going before the class the teacher should first ascertain what the pupils already know concerning the subject, and thus determine where the proper place is to begin the lesson. And the teacher should be able at once to present any fact which the condition of the pupils may indicate as needed.

SUGGESTIONS FOR LESSONS.

CLOVES.

BEFORE commencing this lesson the teacher should procure a few cloves for the pupils to examine, and suspend maps of the hemispheres, that the location of the places named may be pointed out before the class.

Teacher. How many of you can tell me what I hold in my hand? How many have tasted cloves?

Pungent.—How do they make the mouth feel? Can you tell me of other things that have a hot, biting taste? What do we call this taste?

Aromatic.—Did you ever smell of cloves? Is the odor so pleasant that you would like to smell it again? When anything has a strong, pleasant, spicy odor, like that of cloves, we say it is *aromatic.* Can you tell me of any other thing that is aromatic?

Fragrant.—There is another word which we use in speaking of an odor that is pleasant to the smell, but not spicy; it is *fragrant.* Some things are fragrant that are not aromatic. A rose is fragrant; *cloves are fragrant and aromatic.*

Please notice the shape of these cloves. Did you ever see anything that resembled this shape?

Pupils. Yes; it has a head, body, or shank, and point, somewhat like a nail.

T. This is called a *clove* because of its shape. The name *clove* comes from *clou*, a French word for nail, because the clove resembles a French nail in its shape.

Its Country.—Now let us find on the map the places where cloves grow. The clove is a native production of the Molucca Islands, north of Australia. Who will point out these islands?

The clove was originally produced chiefly on the island of Amboyna. The French introduced the clove-tree into the islands of Mauritius and Bourbon, east of Madagascar. Who can show us where these islands are?

The clove-tree was afterward taken to French Guiana, in South America, and from thence to the West India Islands. Who will point out these places?

The clove-tree somewhat resembles a cherry-tree. It grows from fifteen to twenty feet in height, and lives from seventy-five to one hundred years. It commences to produce cloves when eight or nine years old. The trunk of this tree is slender, bark smooth, and the leaves remain on the tree during the greater part of the year.

The blossoms grow in clusters — from nine to eighteen in a bunch — and bear a slight resemblance to those of the honeysuckle. Their color changes from yellow to red. A single tree will produce several hundred thousand flowers in a year, and yield from five to ten pounds of cloves. The culture of the clove is

easy, as the trees require no more attention than cherry-trees. The harvest takes place from October to December.

Cloves are the unexpanded flower-buds, gathered before the flowers open, and then dried. The calyx tube forms the long part of the clove; the corolla, enclosing the stamens, forms the ball in the centre, around which are four pointed leaflets. The bunches of flower-buds are gathered by hand, or by means of a crooked stick, and dried by a hot sun.

Oil of cloves is obtained from the juice of the flower-stalks.

Cloves are used for domestic and medicinal purposes, because they are *pungent* and *aromatic.*

Now write on your slates answers to the following questions:

What kind of a substance is a clove? What are cloves? Where are they obtained? What are their qualities? What are their uses?

PEPPER.

Its Country.—The pepper-plant is a native of the East Indies. It is a climbing vine, with stems from eight to twelve feet in length. The leaves are dark green, thick and leathery; broad at the base, and pointed at the apex, and resemble the ivy. The flowers, which grow in close spikes, are green and insignificant. These are succeeded by a compact cluster of round green berries, which change to a bright red. The berries are gathered as soon as they redden. If allowed to ripen on the vine, they lose their pungency, and fall off.

The plant is propagated by cuttings, and is supported by poles, or by trees planted for the purpose, upon which it is trained. The vine begins to bear fruit when three or four years old. The best crops are produced when the plant is from five to eight years old. The vine becomes useless after twenty years.

The berries are gathered twice a year, and placed on mats to dry in the sun, when they become wrinkled and black.

White Pepper is produced by soaking the dried berries of the black pepper in water until the wrinkled skin becomes soft, and then rubbing it off. This process destroys some of the pungency.

Uses.—Pepper is used as a condiment for food, and as a powerful stimulant and tonic in medicine. Its value depends upon its pungent quality.

Cayenne Pepper.—Cayenne pepper is cultivated in large quantities in Guiana, South America, and shipped from the port of Cayenne. This plant is commonly cultivated in the United States, picked while green, and used for pickling. When allowed to remain on the stalk until ripe, it becomes bright red. After the ripe pods of the Cayenne pepper are picked and dried, they are ground, and thus form the red, or Cayenne pepper, used on our tables.

Take your slates and write all you can remember about *pepper*—where it grows; how it grows; how it is gathered; where the plants are raised; the kinds of pepper; its qualities; its uses, etc.

Let the several pupils read what they have written. Call attention to faulty statements, and make such suggestions as will tend to improve the arrangement of the facts, the manner of presenting them, and aid the pupils in the use of good language.

ALLSPICE, JAMAICA PEPPER, OR PIMENTO.

Where it Grows.—The pimento-tree, which produces the berries commonly known as "allspice," grows abundantly in Jamaica and other West India Islands. It attains the height of about thirty feet. The trunk is gray and shining, and contains numerous branches, covered with dark green leaves; and when bruised they emit a fine aromatic odor. The blossoms are white and numerous. A grove of pimento-trees in blossom presents a most beautiful appearance; and during the months of July and August it perfumes the air with a most fragrant odor.

When the tree has attained its seventh year the harvesting of its berries is commenced. In a favorable season a single tree sometimes yields a hundred pounds of dried berries.

Soon after the flowers disappear the berries are ready for picking, for they must be gathered before they ripen, or the berry becomes valueless. The berry is nearly twice the size of the

common black pepper, and contains two small seeds, closely packed in a shell.

The harvest commences in September, when the green berries are gathered by hand. One person on the tree gathers the small branches, while children pick up the berries that fall on the ground. These berries are spread on floors made for the purpose, and exposed to the sun for about a week. During this time they are frequently turned and winnowed. During this drying process they change from a green to a brown color. They are then put into bags, ready for market.

This spice is sometimes called by the name of the tree that produces it—*pimento;* and sometimes designated by the name of the island that produces it in the greatest abundance, and from which it is chiefly sent to other countries—*Jamaica;* but more commonly it is called *allspice*, because it has been said to combine the flavor of all the other spices. What are its chief qualities? Is it pungent? Is it aromatic?

It is used chiefly for flavoring food. *Oil of pimento* is obtained from the leaves.

Why would you call allspice a vegetable substance?

Now write all the facts you can remember about *allspice*—what it is; where it grows; how it is gathered; what are its qualities; what are its uses, etc.

NUTMEG.

Its Country.—The nutmeg-tree is a native of the Banda Islands, in the Indian Archipelago, but is now extensively cultivated throughout the East Indies. This tree grows from twenty to twenty-five feet in height, and resembles a pear-tree. The flowers are pale yellow, and grow in small bunches.

The fruit is of a cream color, and resembles a peach. When ripe, the fleshy part splits into two halves, showing the kernel, or nutmeg, surrounded by a stringy covering of a scarlet color, which becomes yellow by drying. This net-work sheath has an agreeable smell and an aromatic taste, and when dried forms the article known as *mace*.

Under the mace part of the nut there is a hard, thin shell of a dark brown color, and within this shell is the kernel of the nut, which is the real nutmeg used in food. The fleshy part of the nutmeg fruit is sometimes used as a preserve.

There are three nutmeg harvests in a year—April, July, and November. The fruit is gathered by means of a hook on a long stick. The fleshy part and the mace are removed; then the nutmegs, in their shells, are dried over a slow fire for about two months. The nuts will then rattle in the shell, and the shells are broken with mallets, and the kernels, or real nutmegs, taken out.

Nutmegs which have a white, chalky appearance, have been dipped in lime-water to preserve them from insects. Nutmegs sent from the island of Penang, where immense quantities are cultivated, are seldom soaked in lime-water.

A good tree will yield from ten to fourteen pounds of nutmegs and mace. The trees commence bearing when about nine years old, and sometimes live to the age of seventy-five years. What are the chief qualities of nutmegs?

Mace is dried in the sun, then sprinkled with sea-water, after which it is ready for the market. What are the principal qualities of mace?

Is mace a vegetable substance?

Write on your slates all you have learned about *nutmegs* and *mace*. Tell me where they grow; how prepared for market; their qualities, uses, etc.

GINGER.

Where it Grows.—The ginger-plant, though a native of the East Indies, is now cultivated in the West Indies, and in some of the warm portions of America. It is a kind of reed, growing in a moist soil, from two to three feet high. It has a fleshy stem, which grows under ground, like that of the iris, or sweet-flag.

These fleshy root-stocks are dug up annually after the stems wither. The digging usually takes place in January and February. They are cleaned, then gradually scalded in hot water; then they are exposed to the sun until thoroughly dried. Afterward

they are put into bags which hold about one hundred pounds each, and sent to market. For making preserved ginger the plants need to be only about four months old; but for the dried ginger they must be a year old.

White Ginger is prepared by washing and scraping each root, and drying it in the air without scalding.

Preserved Ginger is made from the young root-stocks, after they have been washed and scalded till tender; then they are put into jars and covered with a thin sirup, which is poured off after a few days, and a thicker sirup added. This last sirup is also poured off, and a still thicker one put on. Sometimes this process is repeated four times. These discarded sirups are diluted with water, and used as a cooling drink.

Ginger is *pungent*, *aromatic*, and *fibrous*.

Now write on your slates all the facts you can remember about *ginger*—what it is; where it grows; how gathered; how prepared for market; its qualities, uses, etc.

CINNAMON.

Where it Grows.—The cinnamon-tree is a native of the island of Ceylon, but grows in other parts of the East Indies. While it will grow to the height of twenty or thirty feet, it is allowed to reach only about ten feet under cultivation. Numerous shoots spring from the same root; these are cut, when from a half to three-quarters of an inch in thickness, into lengths of about three feet each, to be convenient for peeling. The time for cutting the shoots is between May and October. The sticks are taken to a shed prepared for the purpose, and the bark is cut open lengthwise two or three times, according to its size. Next day the bark is easily removed in strips. Then it is soaked, and the outer skin or bark is removed; after which, it is first placed in the shade, and lastly in the sun, where it dries and rolls up into quills, as we find it in the stores.

Around the places where the peeling of the bark is carried on a most exquisite aroma is diffused. The best cinnamon is that

peeled from the middle of the shoots—it is quite thin; that which comes from the top of the branch is next in quality; and the thick bark from the base is the poorest.

The tree blossoms in January. The flowers grow in clusters much like those of the lilac. The berries are no larger than small pease, and when boiled they yield an oil which becomes hard like wax when cold. This *cinnamon wax* is sometimes made into candles for the use of the court.

From the roots a species of camphor may be obtained by distillation; from the leaves and the broken pieces of bark *cinnamon oil* is distilled.

The bark of cinnamon is *pungent* and *aromatic*. It is chiefly used for domestic purposes.

Write on your slates the names of all the pungent substances about which you have had lessons. Name those that are aromatic also. Name those that are fragrant. Name other substances that are pungent; that are aromatic; that are fragrant.

Tell what *cinnamon* is—where and how obtained; its uses, etc.

SAGO.

Did you ever see any sago? What is done with it? How many of you have eaten sago pudding?

What is Sago ?—I will show you a sample of *pearl sago*, such as is commonly used in this country. It is a kind of starch made from the pith of the sago palm, which grows most abundantly in the East Indies. This tree grows to the height of twenty or thirty feet, and from five to six feet in circumference. It is usually cut for obtaining the sago when about fourteen years old.

How Sago is Obtained.—The trunk of the sago palm consists of great numbers of thread-like fibres passing up through its entire length, and between these fibres is a soft substance which readily crumbles into a kind of meal when dried. From this meal-like substance the sago is prepared.

The tree is cut down just before the flower-buds open, and the trunk is cut into pieces of about six feet in length; the outer

coating or bark is removed; each piece is put into a bag made of plantain-leaf (these bundles weigh about thirty pounds each), and these sago bundles are sent to Singapore and China, where pearl sago is principally manufactured.

These sago bags are washed, pounded, and scraped, to remove all the meal from the woody fibres. This meal or flour is soaked, washed, strained, drained, dried, passed through a sieve, and again dried over a fire. A single palm will produce from three hundred to five hundred pounds of meal.

Common sago-meal is made into cakes and baked. Sometimes it is boiled until it forms a thick glutinous mass, and is then eaten by the natives of the Malayan Archipelago. These sago cakes will keep for a long time.

Now take your slates and write answers to the following questions: What is sago? Where does the sago palm grow? How is sago manufactured? Write any other facts about it that you remember. Tell what kind of substance it is.

TAPIOCA.

Did you ever eat tapioca pudding? Would you like to know what tapioca is?

Tapioca is made from the root of a poisonous plant called *mandioca.* This plant holds an important place in the materials for the food of Brazil. Its root is remarkable for being highly nutritious, and also containing a deadly poison. This plant is extensively cultivated in Brazil. Its root is very large, sometimes weighing twenty or thirty pounds; in shape it is somewhat like the parsnip, and of a fibrous texture.

How Tapioca is Prepared.—In the process of preparation for food, the roots are first boiled and the skin removed; then the root is pulverized by means of a grater. The pulpy material is then placed in sacks, put under a press, and the poisonous juice squeezed out. The pulp is removed from the sack, broken in pieces, and heated until it is dry. In this state it constitutes the *mandioca* or *cassava meal*, which is white, but coarse. It is made

into thin cakes similar to pancakes, and baked. When dry and crisp they are cooled, then packed away for future use. This meal is used in many forms of food for the Brazilian tables.

When the poisonous juice is squeezed out, fine particles of the meal, or starch, pass out with it. This starch is allowed to settle, the juice is poured off, then the starch is washed several times, and afterward dried over a slow fire, which drives out all the poisonous properties, and forms that semi-transparent substance which we know as *tapioca*, from which such excellent puddings are made.

Here is some of the tapioca as it appears when sent to market.

Now write on your slates answers to the following questions: Where is tapioca obtained? What is it made from? How is it prepared? What effect does heat have on it? For what is it used? What kind of a substance is it?

SUGAR.

Introduction.—The lesson may be introduced by a conversation in which the answers of the pupils suggest succeeding questions, somewhat as follows:

If you had some candy, what would you do with it? Why do you eat candy? What makes candy sweet? Where do we get sugar? Does sugar grow, or is it made? What is sugar made from?

Is sugar an animal or a vegetable substance? Why do you call it a vegetable substance? From what vegetables is sugar made? What part of the sugar-cane is used to make sugar? What part of the maple-tree is used to make sugar? What is done with the sap, or juice, to make sugar? Did you ever see any one make sugar?

About Making Sugar.—Most of the sugars, molasses, and sirups used in this country are made from the juice of the sugar-cane, which grows abundantly in some of the Southern States, in the West Indies, and in the Sandwich Islands, or made from the juice of the sugar-maple, a forest tree common in the Northern States and in Canada.

The juice of the sugar-cane, also the sap of the maple, are boiled, to evaporate the water, then strained, skimmed, and clarified, to make it pure; and then boiled again until it becomes a thick, sweet sirup for molasses; or if sugar is to be produced, the sirup is boiled longer, until it will granulate or crystallize as it cools.

About Raising Sugar-cane.—Sugar-cane is raised chiefly from cuttings. For the purpose of planting, the top joints of the cane are used. The cane is cultivated in rows from four to six feet apart, with the plants about two feet apart in the rows. The roots of the cane live for several years, but deteriorate after a few years; therefore fresh cuttings are usually planted each year in a part of the plantation. The planting is done in the fall. The time required for the cane to ripen differs, with the variety of the plant, from ten to fifteen months.

Each root usually sends up several stalks, somewhat resembling broom-corn, which grow from six to fifteen feet in height. It arrives at maturity in a little more than a year. When the cane is ripe—which is generally from February to April—it is cut near to the ground, the leaves are stripped off, and the stalks are cut into convenient lengths to be taken to the crushing-mill, where they are squeezed between iron rollers. The strained juice flows into a large vessel, ready to be manufactured into sugar.

About Obtaining Sap from Sugar-maple.—When warm days of spring cause the sap of the sugar-maple to begin ascending to supply the buds with nourishment, a hole of about an inch in diameter is bored into the tree, from one to two inches deep; and just below the hole, or in it, a small spout is fixed to convey the sap into a tub or trough. When the nights are cold, and the days sunny and warm, a pail of sap may be obtained from each tree daily. The sap is gathered in buckets, carried to the sugar-camp, which is generally placed near the centre of the maple grove, and there it is boiled into sirup. About 40,000,000 pounds of maple sugar are made in the United States and Canadas each year.

Large quantities of sugar are consumed annually. Probably 200,000 tons are used in the United States; and in all the coun-

tries of the world together, about two and a half millions of tons of sugar are made and consumed each year. About ten-twelfths of this amount is made from some kind of sugar-cane.

Beet Sugar.—In France, Belgium, and Germany sugar is manufactured from the sugar-beet; and it is estimated that at least 350,000,000 pounds of beet sugar are manufactured annually in Europe.

Now take your slates and write the necessary facts about sugar to complete the following statements, and also add other facts concerning it:

Sugar is made from ———, and of ———. The sap of the maple is obtained in ———, by ———. It is made into molasses and sugar by ———.

The juice of the sugar-cane is obtained by ———. It is made into sugar by ———. In some countries sugar is also made from ———.

Each year about ——— pounds of sugar are consumed ———.

COFFEE.

What is coffee? What is this kind of drink made from? Where does the coffee-bean grow? How many would like to learn more about coffee?

Coffee-tree.—The coffee-tree is a native of Arabia, and the use of its berries, it is supposed, was discovered by the Arabs. This tree is now cultivated extensively in the East and West Indies, and in South America. It flourishes best in elevated regions of warm countries.

The trees are usually raised from seed sown in nursery-grounds. The young plants are set in rows on the coffee plantation, from five to ten feet apart. The trees are also raised from slips. The tree attains the height of six or twelve feet, according to the condition of the soil and climate. It begins to bear when two or three years old, and continues bearing twenty or thirty years. The leaves are evergreen, and somewhat like those of the laurel. The blossoms are white, and resemble the flowers of the jasmine.

Fruit and Seeds.—The fruit of the coffee-tree is a red berry which resembles a cherry. The pulp encloses two oval seeds, each with a convex and a flat side, which grow with the flat faces together. When ripe, the berries are picked by hand on some plantations; on others, cloths are spread beneath the trees, and the ripe fruit shaken off. Some planters remove the pulp by a pulp-mill as soon as the berries are gathered, then wash and dry the seeds. Some planters allow the berries to dry for a few weeks; after which the husk and dry pulp is separated from the seeds by a mill.

After the pulp has been removed, and the seeds are dry, they are passed through a mill to remove the membranous skin that surrounds the kernel. The beans, as these seeds are commonly called, are afterward packed in bags ready for the market.

Here are a few coffee-beans for you to examine. What differences do you observe in them?

The yellowish and the greenish beans are just as they came from the coffee plantations; the brown beans have been roasted, and are ready to be ground, and now the beverage known as coffee may be prepared from it.

Kinds of Coffee.—The bean of the Mocha coffee is small, and dark yellow. It comes from Eastern Turkey and Arabia. The bean of the Java coffee is larger, and a pale yellow. This comes from Java, and other islands of the East Indies. The bean of the Rio coffee, also that of the West India coffee, has a greenish-gray tint. The flavor of the Mocha coffee is considered superior to that of the other kinds.

It is estimated that 600,000,000 pounds of coffee are raised in the world annually.

To which class of substances does coffee belong?

Now take your slates and state—where coffee was first found; where it is now raised; how it grows; how it is prepared for market; how the beans are prepared for making the coffee we drink; the names of different kinds of coffee; and how much is raised annually.

SALT.

Kinds of Salt.—In giving a lesson on *salt*, samples of different kinds of salt should be shown the pupils, as *table-salt*, *bay-salt*, or *Turk's Island salt*, *rock-salt*. Let the pupils examine each kind by feeling, by observing the differences in the forms of the crystals, and by taste. The natural shape of a salt-crystal is a cube, but these combine into forms somewhat like a hollow pyramid, or hopper-shaped. When the water is evaporated rapidly by fire, the crystals are small; the slow evaporation by the sun produces large crystals.

Its Solubility.—Let the pupils see that salt is soluble in cold water as readily as in hot water; that it is not soluble in alcohol; that it will crystallize by evaporation. Require them to tell its common uses.

Tell the pupils that salt is necessary to both animals and vegetables; that vegetables absorb it from the soil; that food would not digest without salt; that it is always present in the blood. It is composed of two substances: one, *sodium*, a metal which has such affinity for oxygen that it will take fire and burn by throwing it upon warm water; the other, *chlorine*, a gas which would suffocate us if we should breathe it clear. These two substances, when combined, are called *chloride of sodium*, which is the chemical name for common salt.

How Obtained.—Salt is obtained by evaporating salt-water, and by digging it from salt-mines, in which form it is called rock-salt. Most of the salt used in this country is obtained from salt-water. It is known as *table-salt*, or *common salt*. *Bay-salt* and *Turk's Island salt* are manufactured by evaporating sea-water by the heat of the sun. Each gallon of sea-water contains about four ounces of salt.

Where Found.—The most extensive salt-springs from which salt is manufactured are those at Salina and Syracuse, in the State of New York. These springs furnish from 5,000,000 to 6,000,000 bushels of salt each year. The most extensive salt-mines are those of Poland, Europe, which are supposed to embrace a bed of

solid salt 500 miles long, 20 miles wide, and 1200 feet thick. The excavations are so long and wide that houses, stables, storehouses, churches, and streets are cut out of solid salt. In the chapels everything is made of the rock-salt—walls, doors, altars, crucifixes, pedestals, and statues. The air in these mines is dry, and free from bad gases, and everything is kept in a perfect state of preservation. These mines have been worked many hundreds of years.

In the interior of Africa salt is not commonly found by the natives, and they will sell a slave for a handful of salt. The children there suck pieces of salt with as much delight as boys and girls do their sticks of candy in this country.

Among the Arabs and Turks salt is a symbol of fidelity. A man who has partaken of salt with an Arab is bound to him by the laws of hospitality, and is treated as a friend.

To which kind of substances does salt belong?

Write all you can remember about salt; its kinds, its uses; how obtained; where found; shape of its crystals; about its solubility; its chemical composition and name; about the salt-mines of Poland; its scarcity in Africa; its symbol of fidelity, and other facts.

SODA.

How Obtained.—Soda was formerly obtained from the ashes of marine plants. It is now manufactured from common salt by the use of acids, charcoal, lime, heat, and water. Large manufactories are engaged in the process of compelling salt, by the aid of the above agents, to lose its saltness and become the common soda so extensively used for cleaning purposes, for making soap, and in the manufacture of glass.

Carbonate of Soda.—This form of soda, sometimes called "washing-soda," is known to the chemist as *carbonate of soda;* this is used in making soap.

Bicarbonate of Soda, or *hydro-sodic carbonate*, is produced by combining carbonic-acid gas with carbonate of soda. This form of soda is used in bread-making, and in the blue papers of Seidlitz-powders; the white papers contain tartaric acid. Bicarbonate of

soda contains twice as much carbonic acid as the carbonate of soda has. It is the escape of the carbonic acid which causes the effervescence produced by these soda powders.

Write about soda—its uses; how made; different kinds, etc.—and state whether it is a vegetable or a mineral substance.

SOAP.

Uses.—When you wash your hands in the play-ground, can you make them as clean as when you wash them at home? Why not? Why is soap used? When is soap used? Who uses soap for washing clothes?

What other substances are sometimes used in washing clothes? Why are *soda* and *borax* used in washing clothes?

Qualities.—When soap is put in the water and rubbed about, what happens to the soap? It melts. What quality has anything that dissolves in water? What change is made in the appearance of the water by the soap? How does water feel that has had soap dissolved in it?

How Soap is Made.—Soap is made of fat, or oil, and an alkali. Potash and soda are alkalies. An alkali made by soaking wood-ashes in water is called *lye.* An alkali has an acrid, hot, and disorganizing nature. Carbonate of soda is not so strong an alkali as potash, and is less liable to produce injury.

The alkali decomposes the fat or oil, sets free the glycerine of the oil (which dissolves in water), and the fatty acid unites with the alkali and forms the soap. The alkali is the chief agent in cleansing.

Kinds of Soap.—The kinds of soap—named from their condition—are *hard soap* and *soft soap.* Soft soaps are made by using potash or lye as the alkali. Hard soaps are made by using soda as the alkali. Tallow will make a harder soap than oil.

Common Bar Soap is made from fat, soda, and resin.

Castile Soap is made from olive oil and soda, and colored by an oxide of iron.

Fancy Soaps are essentially common soaps mixed with different aromatic oils and coloring substances.

Soap cleanses dirt from clothes by the alkali in the soap dissolving the oily, greasy portion of the dirt, and thus setting the whole free. The ancient Gauls made soap of *ashes* and *tallow.* Why did they use ashes?

Now write on your slates all you can remember about soap; how made, kinds, qualities, uses, etc.

CANDLES.

Call attention to the use of candles; where used; when used; other substances used to give light. Show a candle; let pupils point out and name its parts. **Wick**, made of loosely twisted cotton, extending lengthwise through the middle of the candle. **Tallow**, the yellowish-white substance around the wick, which melts when the candle is lighted, flows up the wick, burns, and makes the light. **Shape** of the candle—cylindrical; one end flat and circular, the other end tapering and conical.

What Candles are Made from.—Candles are made of *tallow*, *spermaceti*, *wax*, *stearine*, and *paraffine.*

How Tallow-candles are Made.—Tallow-candles are sometimes made by dipping the wicks into melted tallow many times, allowing the tallow to harden after each dip. These are known as *dipped candles.* They are also made by pouring melted tallow into moulds in which the wicks have been fastened, and allowing it to cool. These are known as *mould candles.* Candles composed of other substances than tallow or wax are generally made in moulds.

Wax-candles are made by suspending the wicks over the melted wax, and pouring the wax repeatedly over the wicks until they attain the desired size.

Spermaceti is a white, semi-transparent substance found in the head of the sperm-whale.

Wax, the substance made by bees from which the comb is

formed. This is melted and strained to form wax for candles. Wax-candles are the most expensive of all kinds of light.

Stearine, or **Stearic Acid**, is one of the solid substances obtained when fats are decomposed by a chemical process. It does not feel greasy, is firm, dry, and makes an excellent candle.

Paraffine is a white, waxy, inodorous, tasteless substance, obtained from distillation of resinous or bituminous materials. It is obtained from oil of tar. It readily combines with wax, spermaceti, or stearine; and when used for making candles, it is mixed with one of these substances to render it easier to melt by the heat of the burning candle.

The illuminating power of gas is estimated by the number of burning candles that its light equals. The gas-light of one burner generally equals the light of fifteen or twenty candles.

Now write what you can remember about candles—of the materials from which they are made; how candles are formed; the kinds of candles used; about gas-light as compared with candle-light; and any other facts.

PUTTY.

Can you tell me what holds the glass in a window? Who uses putty? Is it used for other purposes than to hold glass in windows?

Qualities.—Its *color* is a dull white, somewhat like dough. It feels *soft* and *greasy*. It can be pressed into any shape.

It is *adhesive*—sticks to glass, wood, or any substance.

It *hardens in air*—the older the putty, the harder it becomes.

It is *impervious to water*, and thus keeps the rain from coming through windows at the edges of the glass.

How Made.—It is made of whiting (a finely-ground chalk) and boiled linseed-oil, kneaded into a doughy mass and beaten with a mallet.

CAMPHOR.

Take this vial, smell the liquid in it, and tell its name. Now take this semi-transparent gum; notice its soft feeling and its

odor, and tell me whether it smells like the liquid in the vial. What is it?

The liquid camphor which you see used at home is made by dissolving camphor-gum, like this piece shown you, in alcohol.

Where Found.—The camphor-gum is obtained from the camphor-tree, which grows most abundantly on the islands of Sumatra, Borneo, and Formosa. This tree often attains the height of one hundred feet, and is from six to ten feet in diameter. The camphor-gum is found in masses, and is obtained by splitting the trunk in pieces and picking out the lumps with a pointed instrument. Some lumps have been found as large as a man's arm; and some trees yield twenty pounds of gum; but commonly not more than half of this amount is found in one tree. Camphor is also obtained by distilling the chipped wood, and then collecting the gum from the liquid.

Camphor-gum is soft, friable, and tough; very volatile, inflammable, fragrant, with a strong odor, and is soluble in alcohol. When taken in large doses, it is fatally poisonous. It is also destructive to insects.

The wood of the camphor-tree is valuable for making boxes and trunks, which will protect clothing kept in them from insects.

Write a description of camphor—its qualities, uses, where obtained, etc.

WHALEBONE.

Teacher. What have I in my hand? What can I do with this piece of whalebone? Can you name any of the qualities that make whalebone useful?

Pupils. It is tough, fibrous, flexible, light, and elastic.

T. [Shows the pupils a piece of a cow's horn, a piece of bone and of whalebone. They examine each, after which the teacher asks:] Which of these two substances, the horn or the bone, does the whalebone most resemble?

P. The horn.

T. That which we call whalebone is not a true bone; it is not a part of the common bones in the body of the whale. It is

found in the mouth of the Greenland whale. It is a *horny substance*, composed of many layers of fibrous plates, which form a compact mass where they are attached to the upper jaw; but as they extend downward from six to twelve feet, they become divided into coarse, loose fibres, forming a fringe-like enclosure along the sides of the mouth. This fringe does not extend across the front of the mouth. There are about three hundred of these blades on each side of the mouth, each of which is from eight to twelve inches wide at its root, and from one to two inches thick. About one ton of whalebone is sometimes obtained from the mouth of a single whale. It varies in quantity and length according to the size of the animal.

Its Use to the Whale.—The food of this whale consists of small shrimps, crabs, fishes, mollusks, and other soft-bodied animals which congregate in shoals of millions in the waters frequented by the Greenland and other whales of this kind. The whale feeds by swimming through shoals of these minute animals with its capacious mouth open, allowing the sea-water, swarming with its food, to pass in and flow out through the back and sides of the mouth; but the multitudes of small animals are retained in the mouth by the great fringe strainer of whalebone; thus the whale is enabled to capture its prey by means of the great whalebone fringes which line its mouth.

Its Uses to Us.—Whalebone may be softened by boiling it, and then it can be cut easily into such shapes as are needed for its various uses. On cooling, it becomes harder, and of a darker color than before boiling. It is used for stretchers of umbrellas and parasols; it is split into fibres and used for brushes, in place of coarse bristles; for framework of bonnets; for stiffening stays and waists of dresses; for whip-handles, and various other purposes in which elasticity is a needed property.

Since the capturing of whales for their oil has diminished so greatly, whalebone has become scarce and dearer.

Write all you can about whalebone; what it is; where it is obtained; its use to the whale; its value and uses to us; its qualities, etc.

NOTES OF LESSONS.

COTTON.

Its Uses.—For thread; for various kinds of cloth—as sheeting, drilling, jean, cotton or Canton flannel, gingham, calico, chintz, muslin, tarlatan, lace, hosiery, paper.

What is Cotton?—A soft, downy substance resembling very fine wool, which grows in pods of the cotton-plant in warm countries.

How it is Obtained.—The seeds of the cotton-plants are sown in rows, four or five feet apart, late in March or in April. The plants generally grow from four to six feet high. The blossoms are of a pale yellow or a faint purplish color. The pods containing the cotton fibre ripen and burst open in August and September, after which the cotton is picked from the plant.

The cotton seeds adhere to the cotton fibre when it is picked, and the first step toward manufacture consists in separating the seeds from the fibre. This is done by a machine called a *cotton-gin.* After this process the cotton is packed in bales of several hundred pounds each, and sent to market, from whence it is taken to manufactories to be spun into yarn, and woven into different kinds of cotton goods. *Where is the cotton raised in the United States taken to be manufactured?*

Qualities that make Cotton Useful.—Its fine, long, and strong fibres. The long and strong fibres make the thread and cloth strong. Its fine, strong fibres make excellent thread. Its fibre is not as strong as that of flax.

Where Cotton is Raised.—In the warm portions of the United States, West Indies, South America, Africa, India, and China. It is most extensively raised in the United States.

Require the pupils to write out a statement of all the important facts presented in this lesson, and to read the statements before the class. Proceed in the same manner with each of the succeeding lessons.

FLAX.

What is Flax?—The strong fibre of an annual plant, with a slender stalk, which grows from two to three feet high, covered with a strong, fibrous bark. The seed of the flax-plant is sown in the spring; the plant bears small, blue blossoms in June and July, and is ready for gathering in August—which is done by pulling it up by the roots and tying it in small bundles.

How Flax is Obtained.—The small bundles of the plant are placed on wet meadows, or under water, where the gluten is soaked out, and the woody stem becomes brittle by partially rotting. The plant is afterward dried, then the woody stems are broken by a machine and beaten out. The fibre is then combed by drawing it over an instrument with long iron teeth, or spikes, set in a board, which forms a sort of comb, called a *hatchel* or *hackle.* By this combing process the coarser fibres are separated from the fine and soft ones, and the flax is made ready for spinning.

Uses of Flax.—It is used for strong thread for sewing cloth, carpets, and leather, for fish-lines, cords, and for linen goods.

Names of Goods made from Flax.—Linen thread, tape, damask, white linen, brown linen, cambric, lawn, towels, handkerchiefs.

Qualities that make Flax Useful.—Its fibre is very long, strong, and durable.

Where it is Raised.—It is grown most extensively in Ireland, but is also raised in Scotland, England, Holland, France, Belgium, Russia, and other portions of Europe; also in the United States.

HEMP.

What is Hemp?—The hemp-plant is native of Asia, but is extensively cultivated in Russia, and is grown also in other parts of Europe and in the United States. The plant is an annual, which grows to the height of five or six feet. Hemp is the fibre of this plant. It is coarser and stronger than that of flax. If carefully examined, it will be seen that each coarse fibre is composed of several minute ones twisted spirally.

How it is Procured.—The hemp is obtained by rotting the woody stem of the plant, breaking it, and then beating it out, much in the same manner as is done with flax.

What is Made of it?—Cords, ropes, and cables; sacking, and various kinds of coarse, strong cloth.

WOOL.

What is Made of Wool.—Yarns, worsteds, flannels, blankets, shawls, broadcloth, tweed, and other kinds of cloth; merino, carpets, rugs, mats, drugget, baize, hosiery, felt, and many other articles of woollen goods.

What is Wool?—By the term wool is commonly meant the fleecy covering of sheep, which is sheared from them early in summer. This name is also given to the covering of some kinds of goats, as the Cashmere and Angora goat, of Asia; and to the Llama and Guanaco of South America. The Cashmere goat has a double covering—one of long, coarse hair, and underneath this one of fine, soft wool, from which expensive shawls are made. The wool of the Alpaca Llama is fine, silky, and long. It is used for alpaca goods and other materials.

Wool is raised in nearly all countries. The most extensive manufactories of cloths and other woollen goods are in England, France, Germany, and the United States.

What kind of a substance is wool?

SILK.

Its Uses.—It is used for sewing-silk, ribbons, handkerchiefs, dress-silk, satin, velvet, curtains, furniture-covering, hosiery, gloves, gauze, crape.

What is Silk?—Silk is the fine glossy web of the silk-worm. It is stronger than the web of the spider. The silk-worm spins this web around itself, in the form of a hollow case called a cocoon, before changing into a moth. The cocoons are about one inch long, and two-thirds of an inch thick. What kind of a substance is silk?

About the Silk-worm.—The silk-worm is an insect in the form of a caterpillar. It is hatched, by the warmth of the sun, from an egg about the size of a pin-head; and it attains the full size—two to three inches long—in about eight weeks. During this time it changes its skin four or five times. As the old skin becomes too small, it bursts near the head, and the caterpillar crawls out with a new dress. At each change of its skin the size increases.

The silk-worm feeds on mulberry-leaves while it is growing. After eating and growing for about eight weeks, the worm stops eating and begins to spin, and continues spinning for about five days. While spinning, it moves its head from side to side, as if winding the fine silk about; and the worm grows shorter as it spins, and winds itself inside of the cocoon.

It next changes into a chrysalis, in a dark-brown case, within the cocoon. In this condition it remains torpid for two or three weeks; then it changes into a moth, makes a hole in the cocoon by softening the threads with a fluid, comes out, lays eggs, and soon dies.

How Silk is Obtained.—In about ten days after the cocoons are finished, the insect must be killed, to prevent it from making a hole in the cocoon, and coming out in the form of a moth. To do this they are placed in a heated oven before the time for the chrysalis to change to the moth, and thus the insect is killed.

The cocoons are next put in hot water, which dissolves the gum and loosens the thread. The whole is now stirred with a bunch of twigs, which catch the loose ends of the threads. Several of these are taken together, to make them strong enough to handle and wind upon a reel. The silk is taken from the reel, and tied up into hanks ready for the manufacturer. In this state it is called *raw silk*. These hanks of raw silk are placed on a six-sided reel, or swift, and wound on bobbins. The silk is now sorted according to its fineness and quality, and then is ready for spinning or twisting.

This raw silk is sent to a mill, where two or more threads are twisted together, and prepared for weaving and other purposes. Manufacturers usually purchase silk in the raw state.

Before the silk is ready for weaving it must be cleansed by boiling it in soapy water. The color is now yellow. To make silk white, it must be bleached; to give it other colors, it must be dyed.

The web of a single cocoon is from three to five hundred yards in length. About one pound of good raw silk is obtained from twelve pounds of cocoons.

Where Silk is Raised.—Silk is raised in China, Japan, and some other places in Asia; in Italy, France, and other countries of Europe; in South America, and in many parts of the United States. Silk goods are most extensively manufactured in France.

Articles Made of Silk. — Silk for sewing; twist for button-holes; ribbons; silks, plain, figured, etc.; satin, crape, velvet, gauze, handkerchiefs, shawls, stockings, gloves, poplins, etc.

LEATHER.

Its Uses.—Leather, in different forms, is used for making boots, shoes, gloves, mittens, harnesses, trunks, valises, book-binding, cushions; seats for chairs, cars, and carriages; covers for carriages; cases, belts for machinery, washers, hose for fire-engines; parchment, on which valuable documents were formerly written.

Kinds of Leather. — Calf-skin, kip, cow-hide, morocco, patent-leather, kid, Russia-leather, harness-leather, sole-leather, sheep-skin, buck-skin, seal-skin, dog-skin, vellum, parchment.

From what the Kinds of Leather are Made. — *Calf-skin* is made from the skins of calves not more than six months old; *kip leather*, from the skins of young cattle, older than calves; *cow-hide*, from the skins of young cows; *sole-leather*, from the skins of the ox, also of the old cow; *morocco*, from the skins of goats; *kid*, from the skins of kids that are killed when too young to eat grass; *patent-leather*, a kind of leather covered with a japan that gives it a smooth surface and a permanent polish; *Russia-leather* is made from the skins of calves, cows, goats, sheep, etc., by a special process of tanning, in which are used willow-bark, red sandal-wood, and an oil, prepared from birch-bark, that imparts to this leather its peculiar odor, and renders it repulsive to

insects; *sheep-skin*, made from the skin of the sheep; *buck-skin*, from the skin of the deer; *dog-skin*, from the skin of the dog; *seal-skin*, from the skin of the seal; *harness-leather*, from thick ox-hide; *parchment*, from the skins of sheep and goats; *vellum*, from the skin of young calves, tanned in nearly the same manner as parchment.

How Common Leather is Tanned.—The process of tanning implies saturating the skins of animals with an astringent vegetable substance, called *tannin*, so thoroughly that it becomes insoluble, and incapable of putrefaction.

Skins are prepared for tanning by first soaking them in lime-water, to loosen the hair and the outer membrane; then they are scraped, to remove the hair and the hard cuticle; then soaked in an alkali, to remove the lime; next they are soaked in a weak solution of sulphuric acid, which opens the pores of the skin and prepares it to receive the tannin more rapidly. At this stage of the process the skins, which are now called *pelts*, are placed in pits, or *tan-vats*, with layers of ground tan-bark between them, and the vat is filled with water. The skins are allowed to soak in this manner for several months. Sometimes the vats are emptied, and the hides placed in the vat again with fresh tan-bark. The best leather is prepared by allowing the hides to soak thus for about two years. Slow tanning makes the leather soft.

By means of the astringent property in the liquid in which the skins are soaked, they become thicker and firmer, and the pores so closed that water does not easily affect the leather. Scraping the leather makes it of uniform thickness; rubbing and oiling it makes it pliable and soft.

How the Tannin is Obtained. — The astringent property in which the skins are soaked—the tannin—is obtained chiefly from oak-bark and hemlock-bark. Hemlock-bark is more commonly used in this country, and oak-bark in Europe. Hemlock-tanned sole-leather is of a darker color than the oak-tanned.

A cord of hemlock-bark will tan about five hides; and it takes the bark of two or more trees to make a cord. The acorn cup and ball of the burr oak of the United States, if collected annu-

ally, would supply tannin for all the hides in this country, and save the great destruction of trees to procure bark for this purpose.

What qualities make leather useful for shoes?

What kind of a substance is leather?

INDIA-RUBBER.

Its Uses. — For making overshoes, boots, soles of boots, suspenders, tape, cord, braces, bands, rings, air cushions and pillows, life-preservers, beds, springs for doors, bearers for springs on railroad cars, bands, balls, tubes.

It is dissolved and spread on cloth for water-proof garments.

It is mixed with pitch, sulphur, etc., and made into a hard substance, from which combs, knife-handles, cups, and other articles are made.

Used for erasing or rubbing out marks of the black-lead pencil; and this use gives it the name "rubber."

Properties of India-rubber. — Children should be led to discover that India-rubber is *soft*, *flexible*, very *elastic*, *tough*, *durable*, difficult to cut; that it is *inflammable;* that its elasticity is increased by warmth, and diminished by cold; that it is *soluble in naphtha*, spirits of turpentine, and ether; that it is *insoluble in water*, alcohol, and acids; that it is *non-absorbent* of water, impervious to water—hence is *water-proof;* that it melts by heat, and remains sticky and glutinous.

What is India-rubber ?—It is the juice of trees which grow in South America and in Asia. In India these trees sometimes grow to the height of one hundred feet, and twenty feet in diameter. The best India-rubber, and that principally used in the United States, comes from South America. This tree grows abundantly in Brazil, along the Amazon.

How it is Obtained.—During the rainy or cool season of the year, deep incisions are made in the bark of the India-rubber (or caoutchouc) tree (*Jatropha elastica*), when a thick, creamy juice, of a yellowish white color, flows out. This may be collected in bottles, and, if closely corked, can be kept in a fluid state for a

long time. It soon dries and hardens in the sun, by which process it loses about one-half of its quantity. The drying is hastened by placing the juice over a wood fire, and at the same time the color is changed from a yellowish white to a color nearly black. Clay moulds of various shapes, as of bottles and shoes, are made by the natives, and the juice is spread over these in successive layers, and dried, after which the clay mould is broken up and removed.

In conclusion, require the pupils to state which qualities render India-rubber most useful. To which class of substances does India-rubber belong?

GLASS.

Its Uses.—It is used for windows, pictures, mirrors, bottles, tumblers, goblets, decanters, vases and other ornaments, chandeliers, lanterns, spectacles, telescopes, watch-glasses.

What is Glass?—A transparent, hard, insoluble, brittle substance, made by melting together sand and soda.

Kinds of Glass.—Crown-glass, sheet-glass (or broad-glass, or cylinder-glass), plate-glass, flint-glass, bottle-glass, window-glass, stained-glass.

How Glass is Made.—The materials of which glass is composed—silicates of potash, soda, lime, magnesia, alumina, and lead, the proportions varying in different kinds of glass—are melted together by great heat in clay pots. The melted glass is manufactured into an immense variety of articles by the use of a hollow tube, or blowing-pipe, and a few other simple tools. The tube is dipped into the melted glass, and a quantity collected on the end sufficient for the desired article. The mouth of the workman is then applied to the other end of the tube, and the glass is blown into a hollow form, rolled, pressed, twisted, cut, or pressed in a mould, to make it assume the desired shape. Melted glass is exceedingly *ductile*, *tenacious*, and *plastic*. After the articles are made in the desired shape, they are placed in heated ovens to cool slowly.

Crown-glass.—The melted glass is taken from the pot on the blowing-pipe, is blown, whirled, and pressed until it becomes

globular, with one side flattened. Then an iron rod, called *pontil*, is dipped into the molten glass, and attached to the centre of the flattened part, after which the blowing-pipe is removed, leaving an opening. This globular glass is now exposed to heat, twirled around with gradually increasing rapidity, which causes the opening to expand, until the glass finally flattens out into a plane surface four or five feet in diameter. The pontil is then removed, and the disk is put in the annealing arch to gradually cool.

Some *window-glass* is made in this manner, and subsequently cut up into panes of the desired sizes. Another mode of making window-glass is by a process in which the glass is first formed into a cylinder, and then cut open lengthwise and flattened. Glass made in this way is known as *cylinder-glass*, *broad-glass*, *sheet-glass*, and *German glass*.

Sheet-glass.—To make sheet-glass, or cylinder-glass, the workman collects a mass of molten glass around the end of his blowing-tube; then, by blowing and rolling, and blowing and swinging it in a vertical circle, and heating and repeating the blowing and swinging, the end opposite the blowing-tube bursts open: this end is trimmed, and the glass has the form of a cylinder. Then the blowing-tube is removed from the other end, leaving a hole, which is expanded to the size of the opposite end of the cylinder. The cylinder is then split open, flattened, and placed in the annealing oven.

Plate-glass.—This glass is made by pouring melted glass upon a heated iron table of the size required, and with raised edges to regulate the thickness. A copper roller is passed over the melted glass to make it smooth and even. This plate is then cooled in the oven. After this it is ground smooth by rubbing two plates together with sand or finely powdered flint between them, and finally polished with emery. This glass is used for mirrors and for large windows in stores.

Flint-glass.—This glass is made of white sand, carbonate of potash, oxide of lead, and alumina. It melts more easily than either crown, plate, or window glass; is softer, therefore is more easily cut and engraved. It is used in the manufacture of table-

ware, bottles, decorative articles, lamps, globes, drops, bells, chimneys, etc. It is made into the various articles for which it is used chiefly by means of the blowing-tube, moulds, etc.

Bottle-glass.—This is made from coarse or common materials, and manufactured by blowing and moulding.

In making glass bottles, where a uniform size and shape is required—and especially where letters are to be made in the glass—the bottles are shaped by means of a mould which can be closed around the unfinished, blown form.

What qualities render glass suitable for the purposes for which it is commonly used?

To which class of substances does glass belong?

SUBJECTS FOR LESSONS.

THE following list of subjects will suggest topics for suitable lessons from which teachers may select those that are adapted to their pupils. The information concerning many of these subjects will be familiar to teachers. The facts needed for lessons on many other subjects can be obtained from books to which teachers usually have access. Lessons upon several of these subjects may be given to a class before those of the preceding pages are presented.

In giving these lessons, the attention of the pupils should be directed to such points as will lead them to observe those characteristics which chiefly distinguish the objects and render them useful. For lessons on fruits, nuts, grains, and other vegetable productions, lead the pupils to consider as many of the following points as may be appropriate to the object under consideration:

1. Is it a fruit, nut, grain, gum, juice, root? 2. Where does it grow? 3. How is it obtained? 4. What does it

most nearly resemble? 5. What is its principal quality? 6. What is its chief use?

If the lesson be on a mineral or metal, let attention be directed to the following points:

1. In what form or condition is it found? 2. What is done with it to make it useful? 3. What are its principal qualities? 4. What are its chief uses?

If the lessons be on manufactured articles, let the attention of the pupils be directed to the following points:

1. Of what substances is it made? 2. Why were these substances used? 3. Could any other substance be used? 4. State processes of the making. 5. For what purpose was it made? 6. Where was it made?

In all of these lessons obtain facts from the pupils, as far as possible. When the object is such that they can easily gain the desired information about it at home or elsewhere, postpone further consideration of it until another day, and request the pupils to gain all the facts possible before the lesson is taken up again.

Dew.—When seen, how formed? [Moisture of the atmosphere condenses on cool objects, just as the water collects from the moisture in the air on the outside of a pitcher of ice-water.] Frozen dew, called *frost.*

Vapor.—Moisture in the atmosphere, too thinly diffused to be seen; or moisture rising and condensing into a very thin, cloud-like condition, somewhat as steam condenses, so as to be visible.

Clouds.—A collection of visible vapors in the sky. When the clouds are condensed by cooler currents of air, so as to form drops, these descend as rain.

Hail and *snow* are produced by these drops freezing, under different conditions.

Rainbows are formed by the reflection of the sunlight in drops

of falling water. To see the rainbow, you must look in a direction opposite to the sun.

Fog.—Cloud-like vapor filling the atmosphere near the ground. Sometimes this vapor becomes so dense that a person can see but a few feet from himself.

SEEDS OF GRAIN-BEARING PLANTS.

Interesting lessons may be given on the seeds of plants used for food. Samples of each might be collected, and kept in small bottles, with the name of the seed on each. In giving these lessons, the following facts will be found useful, to be told the pupils after they have stated all they know concerning that which is the subject of the lesson:

Cereals.—The common grain-bearing plants—*wheat*, *rye*, *barley*, *Indian-corn*, *rice*, *oats*, also *broom-corn* and *millet*—are called *cereals*, from *Ceres*, who was the fabled goddess of corn and agriculture, and who is generally represented as crowned with ears of wheat. All of these grain-bearing plants belong to the *grass family*.

Barley.—The *seed* of a grass-like plant. It is said to have been the first grain used for human food. It is cultivated in a northern climate, and used for food as bread, soups, and malt drinks.

Oats.—The *seed* of a grass-like plant. Each grain grows on a separate branch of the stalk. Oats are used in various forms as food for both man and beast. Oats and barley will grow in colder and less fertile regions than other grain-bearing grasses. When ground, it is called *oat-meal*.

Rye.—The *seed* of a grass-like plant which resembles wheat in its growth. This grain may be cultivated where the climate is too cold for wheat to flourish. Rye is made into flour, and used for bread, etc.

Buckwheat.—The triangular-shaped *seed* of a plant cultivated chiefly in a northern climate. The grain is ground into flour, and used for food in the form of griddle-cakes. The name *buck-*

wheat was probably given to this grain from the fact that its shape is like that of the nut of the *beech*-tree.

Wheat.—The *seed* of a common grass-like plant cultivated in the temperate zones. It is the most valuable of the grains used for food. It is used in a great variety of forms. How many of these can you mention?

Rice.—The *seed* of a grass-like plant cultivated for food. It is chiefly raised in the torrid zone, and in the warmest portions of the temperate zones. Although rice is much less nutritious than wheat, rye, or barley, yet it forms the food of a greater number of the human race than any other grain. What food have you eaten made of rice?

Indian-corn, or Maize.—The *seed* of a large plant of the grass-family. It was originally found in North America, but is now cultivated in many parts of the world. The seeds grow around a central stem called a *cob.* It is used for food for man and beast. When ground, it is called *Indian-meal.*

Broom-corn.—The top of this well-known plant is extensively used for making brooms. The *seed* forms a portion of the food of the people in Arabia and India. In the West Indies the seed is called *negro-corn*, as it is much used for food by the negroes.

Millet.—The *seeds* of this grass-like plant are the smallest of the grains used for food. The Italians make a coarse, dark-colored bread from the flour of this grain. In this country it is chiefly raised for feeding poultry.

Quinoa.—The *seed* of a weed-like plant which grows in elevated regions in Chili and Peru, South America, 10,000 or 12,000 feet above the level of the sea. It is ground into flour, and resembles oatmeal in many of its qualities. The seeds are small and roundish.

SEEDS OF POD-BEARING PLANTS.

Beans.—The *seeds* of well-known pod-bearing plants. They are very nutritious. In what form are beans used for food?

Pease.—The *seeds* of well-known pod-bearing vines. Like beans, they are nutritious, and wholesome as food. How are pease prepared for food?

Lentils.—The *seeds* of a pod-bearing plant well-known in Europe. It is used for food.

FRUITS, NUTS, GRAINS, ETC.

The following classes and names of substances will suggest topics for several lessons similar to preceding ones:

Fruits.—Orange, lemon, fig, date, prune, pineapple, raisin, bread-fruit, banana, peach, plum, apricot, apple, pear, cherry, currant, grape, berries, etc.

Nuts.—Almond, Brazil-nut, chestnut, beechnut, hickory-nut, walnut, filbert, cocoa-nut, peanut, vegetable-ivory, pecan-nut, hazel-nut, butternut.

Grains.—Wheat, rye, corn, oats, barley, rice, buckwheat, bean, pea.

Roots, Bulbs, etc.—Potato, sweet-potato, turnip, beet, carrot, radish, yam, horseradish, onion, lily, tuberose, tulip, crocus, ginger, sweet-flag, etc.

Juices.—Cider, vinegar, turpentine, tar, rosin, liquorice, gum-arabic.

Drinks.—Tea, coffee, chocolate, cocoa, broma, alkathrepta, milk.

Metals.—Iron, steel, copper, silver, gold, lead, tin, pewter, brass, zinc, nickel, shot.

Minerals.—Coal (hard and soft), charcoal, coke, lime, marble, graphite or black-lead, mortar, chalk, alum, borax, pumice-stone.

Miscellaneous Articles.—Brick, glue, matches, gunpowder, gun-cotton, paper, calico, oil-cloth, butter, cheese, rattan, vanilla, earthen-ware, mustard, olive-oil, honey, molasses, arrowroot, Iceland moss.

NATURAL HISTORY.

"Nature is man's best teacher. She unfolds
Her treasures to his search, unseals his eye,
Illumes his mind, and purifies his heart,—
An influence breathes from all the sights and sounds
Of her existence; she is Wisdom's self."

ALFRED B. STREET.

LIVING, moving forms possess the greatest attractions for children. The life and motions exhibited in the animal world, corresponding to the activity of childhood, place animals among the earliest and most interesting objects that awaken the curiosity of the young; hence they furnish materials admirably adapted to cultivating their perceptive faculties, and forming habits of attentive observation.

"Those who have watched the faint dawnings of intellect and the gradual brightening that heralds the day will have observed that children very early become acquainted with certain objects, and indicate, when only eight or ten months old, their instantaneous detection of changes in those things to which they are accustomed. Such observers will testify that, next to the familiar faces of the members of their own family, there are no objects which attract their attention sooner or more powerfully than our domestic quadrupeds. The dog, the cat, the horse, the cow, and the sheep are to them wonders. Not only do they become acquainted with the figure, color, and movements of these animals, but with their various cries; so that long before the infant lips are capable of articulating the name of the dog or of the cow, the bark of the one and the lowing of the other will be attempted, and will be so associated with the animal as to serve instead of a name. Thus

the imitative or natural language of the child precedes the artificial. And ideas relating to a class of natural history objects are among the earliest mental acquirements of children.

"As it is a beneficent law of our nature that the legitimate exercise of every organ and faculty is in itself a source of pleasure, we may feel assured that the use of the observant powers is a source of gratification to the child, and a stimulus which leads to a desire to see more. The object—whether animal or plant—that the child thus sees may be described in a hundred books, and have been familiar for ages to men of science, yet these facts do not detract from the delight of the child. It is new to him; and his pleasure is akin to that of the naturalist, who detects an unrecorded species, and gives it a name, and places it for the first time on the rolls of science."*

Children always find delight in watching the movements and noticing the intelligence of animals, and in listening to stories about them. No department of nature is more attractive to them, or supplies so great an abundance of suitable objects for developing their habits of gaining knowledge from the world around them; yet when left entirely to themselves in this matter of observation, they neglect to see many of the things that are most important to correct knowledge; and they also fail to associate in proper groups the facts which they thus learn. The guiding influence of the competent instructor becomes, therefore, especially beneficial to the young observer, even with such an abundance of attractive materials, by leading him to notice those significant features and characteristics that belong to the different kinds of animals.

Young children need to be guided to that which is best for them to *see much* of, as well as to what is best for them to *eat much* of. With all their fondness for watching the movements of animals, they need to be led to see

* Robert Patterson, in *Natural History in Home Education.*

for a special purpose, and to see things that relate to that purpose. But they may also be allowed to see as much more as they please, if their attention be properly given to those objects which are under investigation.

One of the great mistakes in the plans of education lies in the neglect to provide for a proper use of the valuable materials which nature furnishes so abundantly in the animal world as a means for the early development of the powers of gaining knowledge. The domestic animals, and such others, including insects, as come within the range of frequent observation, engage the attention of children long before they are old enough to commence their first lessons in books. Nature does not weary the young learner, as books do. These facts should be remembered in the arrangement of courses of primary instruction. That which is familiar and interesting to children should be among the subjects of the earliest lessons. Nature should be studied first; then books and nature together, each helping the student to understand the other.

Give children correct ideas of the leading groups of animals, teach them to distinguish their characteristics by personal observation, and to arrange them in classes by such means, and not only will the real interest of children in this subject be secured, but the usefulness of text-books will be largely increased. Children thus taught become real and practical students. By becoming accustomed to observe carefully, to arrange in classes by common resemblances, habits of order are formed which prove valuable at a later period in life, in whatever situation the person so trained may be placed—whether in the office of the lawyer, in the counting-room of the merchant, in the laboratory of the chemist, in the workshop of the mechanic, or in the fields of the farmer.

Among the attractive materials of the animal world appropriate for the early exercises of the perceptive powers

are those animals with whose appearance children are to some extent familiar—as the cat, dog, cow, horse, hen, goose, duck, sheep, pig, mouse; and birds of all kinds. The toad and the snail supply interesting materials for these lessons in nature, because children do not usually expect to find anything instructive in things so common and unattractive.

The peculiar structure and uses of the cat's eye, her cushion-like feet, and retractile nails; instances of the fidelity and sagacity of the dog; the docility of the horse; the gentleness of the cow; the playfulness of the lamb and the kitten; the different movements of birds—as walking, hopping, swimming, flying, their nest-building and migratory habits; the form, movement, and habits of fishes, reptiles, and insects, with the wonderful adaptation of structure to their several modes of life. Also the different voices of animals: as the bark, the whine, and growl of the dog; the mew and purr of the cat; the neigh and whinny of the horse; the bleats of the sheep, goat, lamb, and kid; the cluck and cackle of the hen; the gabble and hiss of the goose; the quack of the duck; the caw of the crow; the whistle of the quail; the songs of the thrush, robin, bluebird, and canary, all furnish materials and subjects adapted to interest and instruct children.

Attention may be also directed to those animals which serve us by their strength, swiftness, and sagacity; and to those that supply so many of our wants by their milk, flesh, honey, wool, hair, fur, skins, horns, bones, tusks, feathers, etc.

The lessons during the early stages of instruction should be short. Give an idea of some one thing, or of the action of some one animal; then stop, let the young learners go away and think and talk about it, and look to see if the thing be really so. Then they will return to the next lesson desirous of knowing more.

The natural fondness of children for animals renders these objects especially appropriate for lessons to develop their humane feelings, sympathy, kindness, and benevolence.

Plants, as well as animals, supply useful materials for the child's development by their beautiful flowers of many shapes and colors; their variety of delicious fruits; their fragrance and flavor; the many forms of their leaves and stems; by the wonders of their growth, and their uses for food, medicine, clothing, building, furniture, fuel, etc. Although these lack the attractive feature of motion which renders the animal world so full of interest to the young, very interesting and profitable lessons may be given on these subjects, which will gladden the footsteps of many weary pilgrims along the road to the temple of knowledge, and enrich them with lasting treasures.

Minerals form an important part of the common objects and implements which the child sees and handles daily. Although not endowed with the power of motion like animals, or of growth like plants, yet they are also calculated to awaken the curiosity of children, and thereby furnish appropriate means for their mental development.

The transparency of glass; the elasticity of steel springs; the flexibility of copper wire; the fusibility of lead; the attraction of the magnet; the usefulness of iron, and its softening by heat; the astringency of alum; and the appearances, qualities, and uses of other metals, minerals, rocks, and soils, add to the great variety of materials which nature abundantly supplies for the development and instruction of the child.

These three grand divisions of nature—*animals*, *vegetables*, and *minerals*—comprise the materials which God

employs in exercising the senses, stimulating the perceptive powers, awakening intelligence, and cultivating the human mind throughout its stages of intellectual development. And these things are especially adapted to the purposes of elementary education, since the aim at this time is not so much the giving of a certain amount of knowledge as it is the awakening of the faculties, and training the pupil to use his own mind.

The introductory lessons on natural history should be graded, and presented in successive steps, corresponding to the different stages of the child's development. The age and capacity of the child should determine as to the extent and minuteness of the observations required, and the amount of information to be gained.

LESSONS ON ANIMALS.

FIRST STAGE.

[*Intended for children at home, and during the first year in school.*]

WHEN children have become sufficiently familiar with their own bodies to be able to point out and name the principal parts, and to tell the use of each organ of sense, they will be ready for the lessons on animals, and prepared to observe the different parts of animals, to compare them with parts of their own bodies, and notice resemblances and differences in the structure and uses of these parts.

The first lessons should not be formal in character, but rather consist of familiar conversations, with abundant opportunities for personal observation by the child. As far as practicable, let the pupil see the object first, and then hear about it. The spontaneous questions by the child that follow his seeing—what is it? what is it for? why does it do so? will it hurt me?—furnish abundant opportunities for instruction, and guide the parent or teacher as to the kind of information that is most appropriate for the young learner during his first lessons.

When the child enters school he has already acquired some knowledge concerning domestic animals, and other familiar ones, through home experiences. The teacher's first aim must be to ascertain the character and extent of this information, and then to follow with appropriate lessons connected with and based upon this knowledge. The following *series of exercises* will suggest some of the methods which teachers may pursue during successive steps in these early lessons.

First Series of Exercises.—To ascertain what animals the children are most familiar with, request them to tell what animals they have seen. When several names have been given, select one animal named, and ask a child, *Where did you see it?* Then ask another where he saw it; repeating the question to several members of the class.

What can it do? is another question that may invite answers from several pupils. This may be followed by other questions; as, *How does it move? What does it eat? Where does it live? What is it good for?* The same or similar questions may be asked about different familiar animals. The pupils should be encouraged to make new observations of each animal that forms a subject of this exercise, and to talk about them at a subsequent lesson.

To further stimulate them in observation, tell the children some simple story about the animal; or, if the exercise be about a cat, ask the children to look at the opening in the cat's eyes when the sun shines, and to look at it at night, or when there is not much light in the room, and to tell their teacher the next day what they saw. They may be requested also to look at the feet of a duck or goose, and the feet of a hen, and afterward tell how they differ. Lead them to tell what the cat does when it is happy; what it does when it is mad. Thus in various ways the teacher may stimulate and lead the children to find out many interesting and useful facts about animals.

Do not tell the pupils that which they can discover. The teacher may choose the object, lead the pupils to it, then leave them to see it, handle it, and learn from it by the exercise of their own senses.

These exercises may be made a part of the lessons in reading and spelling, by teaching the pupils the names of the animals talked about; and to read some of the simple statements as to what they can do, how move, what they eat, etc.

Second Series of Exercises.—Place before the pupils pictures of several of the animals about which conversations have already been held; as cat, dog, cow, sheep, goat, horse, etc. Let

the pupils name these animals as the teacher points at the pictures. Let the pupils, singly, point out and name these animals. Let them point out and name the principal parts of each; as, head, neck, body, legs, feet, tail, back, ears, eyes, nose, mouth, etc.

Select a single picture—as that of a cat. Let the pupils point out and name the principal parts; as, head, neck, body, tail, legs, feet, claws, ears, eyes, teeth, feelers, tongue.

Select the picture of a familiar bird — as hen, duck, turkey, robin—and let the pupils point out and name the principal parts; as head, neck, body, tail, legs, wings, beak, eyes, feet, etc. Proceed in the same way with pictures of the dog, the horse, the cow, sheep, goat, pig, etc.

Third Series of Exercises. — Place the pictures of familiar animals—as cow, horse, and sheep—before the pupils, and request them to tell what each is good for. One pupil might say the cow gives us milk; another, the sheep gives us wool; another, the horse can draw us in a wagon, etc.

Then a single picture may be selected, and the pupils requested to tell all they can about that. If it be the picture of a cow, the pupils might say, "We get milk from the cow; we make butter from the milk; we can make cheese from the milk. Leather for shoes and boots is made from the skin of a cow. The flesh of the cow is called beef. We eat beef." Do not try to make the pupils tell things which they cannot learn by observation, nor such as they would not be likely to have learned by talking about the subject.

Proceed in a similar manner with other familiar animals, and thus lead the pupils to consider their uses—*i. e.*, to answer one of their own questions—What is it for? In this way they may become able to mention, somewhat as follows, many

USES OF ANIMALS.

The Horse is useful for riding, for drawing loads, carts, wagons, sleighs, carriages, cars, ploughing, etc.

The Sheep is useful in supplying wool for clothing, flesh for food, and skin for soft leather.

The Goat is useful in supplying milk for food, and skin for leather.

The Dog is useful to guard the house and barn, to hunt, to kill rats, etc.

Hens and Turkeys supply eggs and flesh for food.

Ducks and Geese supply eggs and flesh for food, and feathers for pillows, beds, etc.

Fourth Series of Exercises.—Lead the pupils to talk about the movements of animals.

First—they may tell what they have noticed concerning the movements of the animals named for the lesson.

Second—then lead them to observe the different movements of animals more carefully.

In conducting this exercise, *the teacher should not tell the pupils* what the movements are, but request them to find out, if they do not already know, and to tell about them during the next day's lesson, which should include a review of the lesson on the previous day.

As suggestions to the teacher relative to the facts which the pupils might notice and mention concerning these movements, the following list of appropriate animals, with their movements, is given:

The Cat can walk, run, jump, and climb.

The Dog can walk, trot, run, leap, and jump.

The Horse can walk, trot, run, canter or gallop, and pace.

The Hen can walk, run, and fly.

The Goose can walk, run, fly, and swim.

The Sparrow can hop and fly.

The Robin can run, walk, and fly.

The Turkey can walk, run, and fly.

The Fish can swim.

The Bee can creep and fly.

The Toad can walk and leap.

The Mouse can walk, run, and climb.

The Squirrel can walk, run, climb, and jump.

The Monkey can walk, jump, climb, and swing.

Use these exercises as reading-lessons from the blackboard; also as lessons in spelling and writing on slates.

LESSONS ON ANIMALS.

SECOND STAGE.

[*Intended for children from eight to ten years of age.*]

When the children have acquired a good variety of facts by their own observation of familiar animals, and the ability to give sufficient attention to a single object to consider more than one of its characteristics at the same lesson, they will be prepared for a second series of lessons, during which they may be led to observe more minutely the peculiarities of each object.

During this second stage lessons may be given that will afford exercise for the child's imagination, and thus give pleasure through a faculty that is very active in early life. In giving this series of lessons, the teacher should use a few interesting facts about each animal in such a manner as to lead the pupils to observe and learn other facts about it.

Some lessons may be commenced by first requiring the pupils to tell all they know about the animal; then the teacher may ask a few questions about special habits of the animal that will stimulate the pupils to try to find answers by their own observations; as, What does it do? How does it get its food? What does it eat? How does it move? Would it like to have you pat it? etc.

Sometimes the lesson may be commenced by comparing the habits of animals with some appropriate occupation; adding a few interesting facts about them, and telling the children how they may see the same things, and many others equally interesting.

Throughout all the lessons in this stage *the constant aim*

of the teacher should be to cause the pupils to see carefully, observe patiently, and learn for themselves.

This series may include lessons on a few animals that the children see only in museums, menageries, zoological gardens, or become somewhat acquainted with by means of pictures.

Some simple classification of animals in groups, by their similar habits, modes of life, etc., may be made in this stage, to give children an idea of kinds or classes of animals.

The following lessons are not intended to be copied by the teacher, and taught to the children; but they are designed to furnish sufficient information for bringing the lessons before the class, and to suggest methods for conducting them. Each teacher should endeavor to make the lessons her own, and to adapt them to the pupils in her class. Concerning some of the animals only the most important facts and characteristics are given, and the teacher is expected to arrange these in an appropriate form for a lesson, with such additional information as she can supply.

After a lesson has been given and reviewed, the pupils should be required to write on their slates, or on paper, the most important facts contained in the lesson. By proper management on the part of the teacher, the pupils may be led to the writing of compositions in a way that will be interesting to them.

THE CAT.

The teacher may introduce the lesson in a way that will gain the attention of the pupils; and this can be secured by furnishing them a little exercise for their imagination, somewhat as follows:

Children, I am going to talk with you about a small animal which all of you have seen. It is fond of staying in the kitchen, and of lying in a warm place. It likes to be noticed, and even

caressed by those who are kind to it. I think some of you have taken this animal in your arms, and felt of its soft fur.

Having thus prepared the class for the lesson, the teacher may proceed somewhat as follows:

Teacher. All who think they can tell the name of this animal may raise a hand? What is its name?

Children. A cat.

T. Very good. Here is the picture of a cat. What do you think it is doing? What do you see on each side of its mouth?

C. Whiskers.

T. That which you call the cat's whiskers are its *feelers.* When the cat puts its head in a hole it can tell by these *feelers* whether the hole is large enough to allow its body to go through.

The cat does not like to lie down in a dirty place. It is more careful about keeping out of the dirt than some children are when they are at play. The cat does not like to have her face dirty. How does she keep her face clean?

C. She washes it with her paws. She licks her paws, makes them clean, then rubs them on her face, then licks them again.

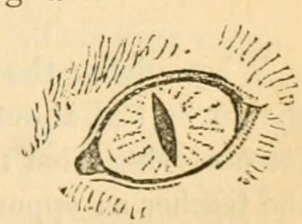
T. Puss carries a brush, and smooths her fur with it. I think some of you have seen her use it. Do you know what this brush is?

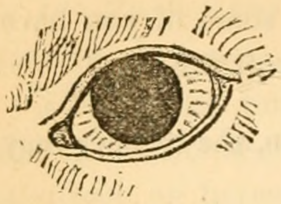
C. I think it is her tongue, for I have seen her lick her fur; and her tongue is rough, something like a brush.

T. You are right; the top of her tongue is covered with horny points, which slant backward toward her throat. With this rough tongue she can make her hair smooth.

Did you know that cats can see in the dark? They have curtains in their eyes of a yellowish-green color. When the sun shines very brightly they draw these curtains together, so as to leave only a narrow opening between them, and let in a little light. When too much light goes into the eye it has a blinding effect, and prevents the cat from seeing well. At night this curtain is pulled back to make a wide opening, to let in enough light to enable the cat to see. By this means the cat can see to hunt its prey at night.

Did you ever look in a cat's eyes when the sun shines brightly on her, and notice how the curtains are drawn nearly together, leaving only a narrow opening? I will try to make a picture on the blackboard to show how the cat's eye looks when these curtains are drawn together.


EYE IN SUNLIGHT.



EYE AT NIGHT.

Did you ever look at a cat's eye at night, when the curtains were pulled so far back that the opening in the pupil of the eye was like a large round spot, or circle? The opening between the curtains of the cat's eye is the *pupil.* The cat sees through the pupils of its eyes as you see through the small circular pupils in your eyes. Have you a cat? What is the color of your cat?

You must look at your cat's eyes when you go home, and see if you can find the curtains; and then watch, as you take the cat near a bright light, to see them draw together; then take the cat where there is but a little light, and watch the curtains as they move back to let in more light.

If you let the cat lick your hand, you can feel the brush with which she smooths her fur.

Did you ever see the cat's pin-cushions? She carries them on her feet, and keeps in them several curved pins, with sharp points. See if you can count the pins in each cushion? What does she do with them?

The cat walks on her cushions. They are so soft that she can walk without making a noise; and the mice do not hear her as she creeps up near their holes to watch for them to come out, where she can reach them with her paws.

What does the cat do when she is happy?

Children. She purrs.

Teacher. How does the cat show that she is angry?

C. She wags her tail, and makes a noise.

T. How does the cat tell you that she is hungry?

C. She mews.

T. How does she tell you that she wants you to open the door for her to come in or to go out?

How many of you will look at a cat at home, and try to find all the things that we have talked about—the *feelers*, the *brush*, the *cushions*, the *crooked pins?*

Some day we will talk more about the cat, and tell you something about her great uncles and cousins that live far away.

When giving the lessons in this stage, two or three exercises should be had about each animal, so as to give the pupils time for observing what may be found that has been talked about, and the teacher an opportunity of correcting mistakes which they may have made. One or two days may elapse between the exercises.

It is important that the pupils be encouraged to tell what they observe, so far as it relates to the points of the lesson, and allowed opportunity to report their observations. When able to write, occasionally change the manner by which the pupils report what they have seen, and let them write what they would say instead of telling it.

THE DOG.

The dog may be made the subject of a lesson, and treated somewhat like the cat. The attention of the children may be directed to the characteristics of the dog somewhat as follows:

There is an animal, which usually lives about the house, that children sometimes use for a horse to ride; sometimes they harness him to their little wagon, and let him draw it around the yard. Some of these animals are so kind to children, and so good-natured, that they will allow little boys to pull their tails and ears, or sit on them and roll them over. I think you have seen one of these animals that was happy to go with you when you took a walk in the fields or in the woods. He is always happy with children who are kind to him and do not tease him. What is the name of this animal?

The dog is a faithful companion of man. He protects his person from strangers; guards his house and other property at night; assists his master in hunting wild game; helps him to care for and drive his cattle and sheep; sometimes he brings his master's daily paper to him; sometimes he takes a basket to market for meat or groceries; sometimes he saves the life of a child that falls into deep water from drowning; and in a great many ways he serves those who are kind to him. His affectionate disposition strongly attaches him to his master, and he will follow him wherever he is allowed to go. He is the companion and friend of man in all parts of the world. A dog has a very keen scent. He can track his master along a crowded street, and can follow an animal for many miles by the scent along its track without getting within sight of it. This fact makes the dog valuable for hunting deer, foxes, and other animals. His sight and hearing are also very keen.

What kind of dogs have you seen? You may tell me their names. Look at the dogs in this picture,* and see how many kinds you can point out.

Now direct the pupils' attention to the *long head* of this animal;

* Show Prang's picture of dogs, or some other one that represents several kinds of dogs.

its long ears; its smooth tongue; strong, pointed teeth; its blunt nails; to its habit of extending the tongue when heated or tired by running; to the tricks which he may be taught to perform; and to his general intelligence. Encourage the children to tell what their dogs can do.

Teacher. What does the dog do to show that he is happy? How does he tell you that he is hungry? How does the dog show you that he is angry?

THE GOAT.

The *goat* being an animal with which children generally are familiar, the teacher can obtain many facts concerning it from them, and then direct their attention to its structure, habits, uses, etc.

They may be led to compare the size of its body and the shape of its head with those of the sheep, and to notice that its slender legs, and its feet with parted hoofs, are like those of the sheep; but that it differs from the sheep in being covered with hair, and in having a tuft of hair, or beard, under its chin.

It eats grass, hay, grain, and vegetables like the sheep, but it will eat also many other things, as twigs, leaves, bark, old paper, and sometimes rags.

Goats like to live on hills and among rocks. They are sure-footed, and can climb the sides of steep, rocky hills where a sheep could not go. Wild goats live in herds on the mountains of Europe and Asia.

This animal belongs to the cud-chewing family. It is often kept about horse-stables, and frequently a horse and a goat become great friends to each other. It is said that goats are the only animals that will boldly face a fire.

The Cashmere goat of Asia is celebrated for its fine gray wool, which grows under its long, silky hair. Only a small quantity of wool—about three ounces—is obtained from a single goat. Expensive Cashmere shawls are made of this wool.

The milk of the goat is used for food; its skin for morocco leather. The skin of the young kid is used for kid gloves. Boys sometimes harness goats to their little wagons, and thus make the goat draw them about.

THE BAT.

In a warm summer evening, after the birds and fowls have all gone to roost, we sometimes see a little creature flying about so swiftly that we can hardly follow it with our eyes. It seldom makes a noise; its wings do not rustle like those of birds; it has no feathers. Did you ever see one of these little animals? What is its name? Why do you suppose it flies about in this manner?

You have seen swallows fly about in the daytime, sometimes near the ground, sometimes close to the surface of a pond of water, and sometimes higher in the air. The swallows were catching flies and small insects for food as they flew about.

When the swallow goes to his nest for the night, the *bat* comes out to catch flies and mosquitoes for his food. Thus you see the bat is a useful animal, and you need not fear it. It does not wish to hurt us; it only wants to catch the flies and other insects which annoy us. Do not fear the bat, but watch the next one that you see, and feel glad that it catches so many flies for its supper.

Bats take a drink of water after eating, but they do not stop to drink; they fly near the surface of the water, and take a sip without stopping.

Look at this picture of bats.* Some are flying, some are hanging up by their hind feet, ready to sleep. This is the way they hang in the daytime when they sleep. They fly about at night, and sleep in the daytime. They sleep in some dark hole in a tree, or in a dark place among rocks. They hang themselves up by their hind feet, and fold their wings around the body as you see in the picture. They sleep all winter without eating.

The head is shaped somewhat like that of a mouse, but its nose is much shorter. Its eyes are very bright. It has long ears, and hears very quickly the least noise. The mouth contains small, sharp teeth, somewhat like the cat's teeth in shape. It will bite if you take it in your hand.

Its wings are very curious. They are made of thin skin, without any feathers. It has a pair of hooks on each wing. When it alights for a moment, it can hold itself up by these hooks. The body is covered with a soft, thick fur like that of a mouse. Some are gray, and some are brown. Did you ever see a brown bat? Were you afraid of it?

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* *Prang's Natural History Series* contains an excellent picture of *bats* in each of these positions.

The cry of the bat is very weak—not so loud as that of a mouse. Did you ever hear a bat squeak or cry? It is said that they are very cleanly; that they comb their fur carefully, and part it with their claws.

Bats and swallows are useful in catching flies and other insects, and thus prevent them from becoming too numerous and troublesome.

THE MOUSE.

Did you ever see that very little animal with bright eyes, soft fur, and long tail, which creeps slyly out of a little hole in the corner, looks around, and then runs quickly across the room? What is the name of it?

Its teeth are sharp and strong, and made for gnawing holes. It has four very small feet, and can run without making a noise. Its tail is long, but very small, and has no hair on it. It has large ears and bright eyes, so that it can hear the least noise and see the least movement. It is a very *timid* animal, and runs away when it hears a noise; but it creeps softly back again when all is quiet. Of what is this animal afraid?

It comes out of its hole to get crumbs of bread and cake. It is very fond of cheese also. Sometimes it gnaws holes in a box or closet to get at something inside. When it has had enough food it goes back to its house, or nest, which is made soft and warm inside, so that the little mice may not get cold.

Do you like to have mice in your house? What do you do to get rid of them? What can you tell about mice? Look at this picture, and tell me what you see in it.*

Children. What a funny mouse, with such a long, long tail!

Teacher. That is called a *jumping mouse;* it is somewhat like a kangaroo — its hind legs are so much longer than its front ones. This mouse does not run like other mice, but it jumps, making long leaps, as you see in this picture.*

The large mouse in the lower left-hand corner of the picture is a *meadow mouse.* Its tail is much shorter than that of the jumping mouse, and it is also shorter than the tail of the house mouse.

The larger picture on the right-hand side is that of a *rat.* The rat and mouse belong to the same family, but they do not often live in the same house.

Can you tell something about mice and rats?

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* *Prang's Natural History Series.*

THE RABBIT.

Most children can tell something about rabbits—of their long ears, pink eyes; that their hind legs are longer than their front legs; that they move by jumps, instead of walking, as cats and dogs do; that they dig holes in the ground to live in; that these holes are called burrows; that some children have pet rabbits.

After all the facts which the pupils can state about rabbits have been given, additional facts may be stated by the teacher, such as that their food consists of grass, grain, vegetables, fruits, and the bark of young trees; that they are very timid when wild; that tame rabbits are white, black, and of other colors, while wild ones are usually brown in summer, but of a grayish-white in winter; that they lay back their ears, so as to hear when an enemy approaches them from behind; that their eyes are so placed near the top of the head that they can readily see anything that comes from either direction; and that they must depend upon flight for safety, as they have no means of defence.

The wild rabbits are full of odd tricks which are amusing. They come from their burrows about sunset, also in the morning just before sunrise. When a person has once seen the comical movements of these creatures in their native home, he will desire to see them again and again in their gambols and laughable antics.

When one rabbit wishes to call another from his burrow, he goes near the mouth of a hole, and with its hind feet gives a tap-tapping on the ground. If a rabbit does not soon come out, he goes to another hole, and repeats his tapping on the ground. Sometimes an old rabbit rushes out, and begins to fight this disturber of his peace. They leap over each other, and kick their enemy with their hind feet; each trying to jump the highest and kick the hardest. They have great strength with their hind feet, and often knock each other down.

Rabbits give a signal of danger by a sound like *tap-pat.* When this sound is made, all the rabbits rush for their burrows. Sometimes rabbits fight by striking their heads together.

The rabbit is a gnawing animal. Its front teeth are like those

of a rat. It often does great injury to trees by gnawing the bark near the ground. The flesh of the rabbit is used for food, and its skin for clothing.

THE ROBIN.

Teacher—holding a picture of a robin before the class—says, How many of you have seen a bird like the one in this picture? All of you? Then Willie may tell the name of it. Mary, where did you see a robin?

Do robins walk or hop when they move on the ground? Do they often stop when walking? Do they walk fast? Did you ever see a robin's nest? James may tell us where he saw a nest, and what it was made of.

James. I saw a robin's nest in an apple-tree. It was built in a fork of the branches, of sticks and grass.

T. Robins often build nests in trees near a house. They make them of small sticks, dry grass, and hair. Only two robins attend to one nest. The female robin gathers the materials and builds the nest, and the male robin acts as a sentinel to give alarm if any enemy comes near; and he guards the nest so that other birds may not steal it while the female is away gathering more materials. It takes three or four days to finish a nest. The female shapes the inside of it by turning round and round in it many times, with her tail hugging it close on the outer rim.

Usually three or four eggs are laid. The robin sits eleven days to hatch her young. In about eight days the young robins are covered with pin-feathers, and their eyes are open; in eleven or twelve days more they leave their nests, and are taken care of by the male robin. As soon as the young birds are out of their shells the male robin provides the food, keeps the nest clean, and sits on it to keep the young birds warm when the mother-bird is absent in search of food.

In a few days after the first brood leaves the nest, the female gathers new materials and builds another nest, usually not far from the first, and prepares for a second family. The robin rears but two broods in one season.

The chief food of the robin is worms and other insects. He is the farmer's best friend. A multitude of insects are bred in the earth, and the robin consumes a large number of them. If all of these insects were left to feed on vegetables and fruits, the destruction of them would be so great that both beast and man would suffer for the want of food.

Robins eat but a few cherries, or other fruits, until after his destruc-

tion of insects has saved the farmer more than the value of his fruit. During a single year a pair of robins will save ten times more fruit and grain than all they consume. The robin deserves to be treated kindly for all the good that he does; but too often he is abused, stoned, and shot by those who do not know his real character and value to the farmer.

The male and female robins do not differ much in size; but the female is of a lighter color, and has no rosy color on the neck and breast. The male bird is often called "robin-red-breast." Both of these birds have large, bright eyes.

It is the male robin whose song is heard ringing out so clearly early in the morning and late at night. The notes of the robin may be heard at the first dawn of light, long before the sun is up, and when evening twilight has faded almost into the darkness of night. Do you know what the robin says when he sings? Somebody told me that he said,

> "Jonathan Gillet scoured the skillet;
> Scoured it neat, scoured it clean."

Listen to his song, and see if you think he says this.

I hope you will watch the robin, learn much about its habits, learn to look at it as a friend, and to treat it with kindness.

THE EARTH-WORM.

I think all of you have seen a long, slender worm of a pinkish color, without legs, crawl out of a hole in the ground after a shower of rain. Did you ever watch the movements of this earth-worm, and learn how it can crawl without legs?

If you examine it carefully as it moves, you will observe that its body contains a great many rings, placed at little distances from each other. If you could count them, you would find more than one hundred in all. When the worm crawls you can see these rings separate, or stretch apart, as about half of the body stretches forward: then these rings come near together again, as the back part of the body is drawn forward.

This worm has four long muscles which extend the whole length of its body; and it can lengthen or shorten these muscles, and thus separate the rings, or draw them together.

The earth-worm has a pointed head, which can be distinguished from the tail by being more pointed than the tail. It has a mouth, but no eyes nor teeth, and does not hear nor smell. It has the sense of touch and of taste. The sense of touch is keen, as may be seen by touching it lightly as it peers above its hole. It feeds upon the soil

it lives in, swallowing it and the half-decayed organic substances in it, and passes them through the body, as may be seen by the casts around their holes.

It is supposed that these worms breed once a year. Their young are produced from eggs, which are laid in clusters at considerable depth in the ground. The eggs are laid in the spring, and hatched in June and July. The egg is about the size of a pea, with a hole in one end, through which the young worm escapes.

If the worm be cut in two behind the belt of rings—which is about one-third of its length back of its mouth—this part of the worm will grow out again; but if the body be cut in two at the belt, or between the belt and the head, the worm will die.

You have probably seen the earth-worm used for bait when fishing, and many think it good for nothing else. The real uses of this worm appear to be to furnish food for moles, toads, frogs, snakes, the robin and other birds, and also for fishes and some kinds of insects. They do more harm than good to vegetation. They eat into roots of plants. The earth-worm is found where man dwells, but not in the forests until carried there by man.

Earth-worms can be destroyed when they become so numerous as to injure plants. They are very thin-skinned, and any hot or caustic liquid—like lime-water or weak lye—will kill them. If the earth be shaken where these worms are abundant, they crawl out of their holes, as if afraid. Some birds know this habit of these worms, and they stamp with their feet on the ground about these holes; and as the worm comes out the bird catches it with its long bill.

THE SNAIL.

Before giving this lesson, several snail-shells should be procured; also two or three live snails.

Let pupils examine the shells and notice the spiral shape; tell them that each turn or twist of the shell is called a *whorl;* that all the whorls together are called a *spire;* that the point of spire, or cone, is called the *apex;* the opening of the shell is called the mouth, or *aperture;* that the line dividing the whorls is called a *suture.*

The shell is a part of the snail, and sometimes is called its house; but the snail cannot leave its house and move about without it. It cannot live out of its house; so, when it moves about, it must carry its house on its back. When the snail wants to move from place to

place, it creeps part way out of its house, so as to get its long foot, or the flat part on which it moves, on the ground. If you place a live snail on a piece of glass, and watch its movements as it crawls, you can see how it moves on its single foot; for the snail has only one foot. As the snail begins to move, you will see little horns, or feelers, on the front part of its head, moving about as if feeling its way along. These feelers have a hard name, and you need not try to remember it; but if you should hear anybody say the *tentacles* of the snail, you may know that they mean the *feelers*, or horns.

Land-snails have four horns, or feelers; and on the tips of two of them may be seen black dots about as large as pin-heads; these are the eyes of the snail. The eyes of the sea-snail are usually on small elevations at the base of the feelers. The mouth is below and between the horns.

Snails and slugs are soft-bodied animals; they have no bones, or rings, or joints in their bodies. They have cold blood, and are covered with a skin, from which oozes a gummy fluid; as the snail crawls along, this fluid leaves a slimy trail behind it.

Lead the pupils to notice how quickly the ends of the feelers, containing the eyes, are drawn back when they are touched. This shows that the snail has the sense of feeling. Let the pupils also notice how the snail eats, by placing it on a leaf of lettuce or cabbage. It breathes by holes in the sides of its body.

In autumn land-snails bury themselves in the ground, retire within their shells, and close the mouth of the shell with a film of gummy mucus. In this condition the snails remain until the warm weather of spring revives them again.

Snails are hatched from very small, jelly-like eggs about the size of homœopathic pellets. A single snail will lay from fifty to one hundred eggs. These eggs possess great vitality, and may be dried so as to crumble between the fingers, yet moisture and warmth will restore them in a single hour. The eggs hatch in two or three weeks; and at first the young snail has a very small shell, containing only one whorl and a half; but the shell grows larger as the snail grows.

By placing several snails, early in spring, in a box with earth, rotten wood, or damp leaves, their eggs may be seen in a few weeks. If the eggs are kept on moist leaves in a warm place, they will hatch out, and small snails grow during the summer. If the shell of the snail becomes broken a little, the snail can repair it.

Slugs are snail-like animals; but they have no shell or house. They are found on plants in gardens, and on the under side of boards lying on damp ground. Slugs are very destructive to plants.

Sometimes the gardener puts dry ashes around his plants to keep the slugs away.

The *slug* can spin a thread of the slimy substance with which it makes a path to creep on, and lower itself from a table to the floor; but it cannot creep back again on this thread.

Some slugs lay five hundred eggs. Toads eat slugs.

THE TOAD.

Sometimes when you go in the garden or walk along a road-side, after a shower, you will see a little animal hop out of your way; and I suppose some of you wonder where these toads came from, and what they are doing. Toads dig holes in soft earth, or hide under leaves. When a rain is over, they hop out of their hiding-place, and hunt for slugs, worms, and flies for food.

It is very interesting to watch a toad in the garden, as he sits close to the ground under or near some plant, and waits for a fly or a worm to come near him. If one appears, the toad does not seem to notice it; but as it comes near, the tongue of the toad darts out suddenly, draws the insect quickly into his mouth, and swallows it. The toad does not seize the insect while it is motionless; but as soon as it moves, as if to get away, the wonderful tongue pulls it into his mouth. And the toad continues to sit quietly in his place, waiting for more food to move within the reach of his tongue.

The toad is a much-abused creature. Some people say that he is poisonous; that if you touch him warts will come on your hands; and many other bad things are falsely said about the toad. Its skin does contain an acrid fluid, which it can cause to flow over its body for a defence against dogs and other animals. This is very offensive to dogs, but it is not poisonous to the touch. The fact is, the toad is a very useful animal, both in gardens and in fields. He moves around at night, devouring many kinds of insects, as slugs, worms, moths, caterpillars, crickets, flies, etc. Sometimes gardeners collect a large number of toads, and place them among their plants, that they may destroy the insects. Toads are sometimes tamed, and then they will creep out of their hiding-place, on hearing a familiar call or whistle, to eat the flies, spiders, beetles, slugs, or other insects that are placed before them.

Do not abuse the homely toad; he is much better than he looks. When you have watched him while he catches flies, and remember how useful he is, you will not think of his appearance.

Did you ever see polliwigs in a small pond of water in the spring-time? Tadpole is another name for this little animal. Do you know

what becomes of these tadpoles? If you should take some of them out of the pond, and keep them in a basin of water for a few days, you would see some wonderful changes. First, two small feet and legs would come out near the tail. Soon afterward two more legs would appear near the head. In a few days after the tail becomes shorter and shorter, until it all disappears, and the tadpole has become a *toad;* it then creeps out of the water, and hops away to hunt for food. Did you ever catch tadpoles, and watch them as they change into toads?

I will tell you one more interesting fact about the toad, which you might not learn unless you should watch him for many months. The skin of the toad is its dress. As the young toad grows, his dress becomes too small for him, and it splits open; then he pulls it off, and eats it up. How do you suppose he gets a new dress? Before the old skin splits open, a new skin grows under it; so, when the old dress is pulled off, the new dress is already finished and on the toad. In this way the toad changes his dress once a year; and he rolls the old dress up in a ball and swallows it. Snakes change their dresses once a year, but they do not eat up their old clothes; they crawl out and leave them. Perhaps you have seen an old dress that some snake had left on the ground.

THE GRASSHOPPER.

Did you know that a grasshopper is a *fiddler?* You have heard the music made by this insect, and many have supposed that he made it with his mouth, as children do when they sing; but that is not the way his music is made. I will tell you how he does make his music; then, if you sometimes see him while he is fiddling, you will know what he is doing.

If you will carefully examine a grasshopper, look at the veins running through the wings and in the wing-covers, and also examine his hind legs, and you will see what he uses for his fiddles. The *edges of the wings* and the *wing-covers* are the *strings*, and the *hind legs* of this insect are the *bows.* When the grasshopper begins to play on his fiddles, he bends the shank of one hind leg beneath the thigh, and then draws the leg up and down against the edges of the wings or wing-covers. He does not use one bow all the time, but changes, and moves the shank of the other hind leg as before, playing awhile with that. Some grasshoppers rub one wing-cover upon the veins of the other; some rub together the front edge of the wings and the under surface of the wing-covers.

Crickets make their chirping sounds by rubbing the base of one

wing-cover upon the veins running through the middle of the wing.

I will tell you how to get very near a grasshopper, so that you can see him fiddle. When you hear a grasshopper's music, walk very quietly toward the sound until it stops, and then wait for it to begin again. Now try to determine the location of the insect; then step quickly, but quietly, within five or six feet of the fiddler, and get on your hands and knees; then rub the edge of a quill on a file, which you have taken with you, to imitate the sounds of the grasshopper. First make the sounds softly, separating them by considerable intervals; then make them louder, and in quicker succession. In a little time the grasshopper will forget his fears at your approach, and begin to fiddle so loudly that you can creep still nearer, so as to see all the movements of your insect musician.

Grasshoppers shed their skins several times as they grow larger. You may be able to find some of this young musician's old clothes —fiddle, strings, and bows—hanging on a spire of grass, and then you can examine them carefully.

Grasshoppers are hatched from eggs. The young grasshopper is very small, and has no wings. As it grows, its first suit becomes too small, splits open, and the insect crawls out in a new suit of clothes. The insect continues to grow—changing his old clothes for new ones—until he has attained his full size, and has all his musical instruments complete.

Sometimes little boys are cruel to these fiddlers, and steal their *bows*. Then the poor insect cannot make any more music, nor hop out of your path. Is it right to treat the grasshopper so?

THE SPIDER.

Some spiders are *spinners* and *weavers;* some are *hunters;* some fly *kites;* and some are *balloonists.* When would you call a spider a spinner? When a weaver? When a hunter? Can you tell what they do that resembles kite-flying? Did you ever hear of their making balloons, and going up in the air with them?

Weaving-spider.—Probably the pupils will be able to tell something about the spider spinning and weaving its web; possibly they may have seen the woven webs prepared for catching flies. Having obtained from the pupils what they know about this work of the spider, proceed to give other facts; among them, tell how the spider hunts for food.

Hunting-spider.—This spider does not build nests, but it wanders about until it comes near a fly or other insect, then it suddenly springs

upon it like a cat. The hunting-spider is small, and its color black and white.

The Spider's Kite.—When a spider wants to stretch a web from one high place to another—as from a post to a fence—she watches and waits until the wind blows in the right direction to carry her fine string where she wants to fasten it. Then she spins a little ball or bunch of web, fastens the fine string to it, and as she spins lets the wind carry her kite and string to the fence or other object. When it reaches the desired point, and becomes fast, the spider fastens her end of the thread, and then goes over the fine string and fastens the other end more securely. Sometimes she adds one or two more threads to this line, to make it stronger.

The Balloon-spider.—The balloonists are young spiders. When the air is favorable, they throw up long threads which float in the air. These threads are folded together at the bottom, so as to form a place for the young spider to lie. When all is ready for the start, the little air-voyager gets upon her balloon, folds up her legs, and the wind carries her a long distance over the fields. In the autumn the long threads of the balloon-spider may be seen in the morning on the grass, covered with dew.

Insects.—Ants, flies, bees, and butterflies are *insects.* Their bodies are divided into three parts—the *head*, the *middle body*, or *thorax*, and the *hind body*, or *abdomen.* The legs and wings of insects are attached to the middle body.

If you examine the body of a spider, you will find it divided into only two parts—the *head body* and the *hind body.* Spiders have *eight eyes*, like small black beads, and *four pairs of legs.* Flies, bees, and ants have only three pairs of legs. The feet of the spider are adapted to walking on the web. Each foot is furnished with three claws; the middle one is bent over at the end, forming a long finger for clinging to the web, or for guiding the thread in spinning. The outer claws are curved, and toothed like a comb. Opposite the claws are several stiff hairs, which are toothed like the claws, and serve as a thumb for the claws to shut against.

At the hinder end of the spider there are little protuberances, called *spinnerets*, arranged in pairs. These contain a fluid somewhat resembling the white of an egg. The spinnerets are covered with fine, jointed, hollow hairs, through which this fluid flows out, forming the finest of fibres—so fine that hundreds of them united together form the single thread of a spider's web, which is strong enough to hold a fly when struggling to escape.

There are many kinds of spiders, and they have many interesting habits, which may be discovered by carefully watching them. The female spider does the spinning and weaving, and she lives on the web when finished. The male spider is seldom seen during the daytime.

The young spiders are hatched from eggs; and they shed their skins, as they grow up, as grasshoppers do. The eggs of the spider are deposited in a ball-like sack; and this sack may be found under stones, boards, logs, etc. The sack of spiders' eggs may be kept in a box or bottle, and in due time the young spiders will hatch out. A hundred of them may hatch from a single sack, but usually not more than one-tenth of them live to reach adult size.

Although so generally dreaded, spiders may be handled with safety. They can bite only that which comes between their jaws, and these are so small that it is very rarely that they attempt to bite anything except an insect. Each little jaw of the spider has a minute hole near the end; and when an insect is bitten a small drop of a poisonous fluid is forced through these little holes into the wound inflicted, and this kills the fly or other insect. This poison has about the same effect on a person as the bite of a mosquito. Very large spiders—such as are found in hot countries—are more poisonous. The common spider is very timid, and is more anxious to escape by running away than to defend itself.

THE BUTTERFLY.

Teacher. What are hats for?

Children. To wear on the head.

T. I thought so; but I saw a boy spoiling his hat by trying to catch a butterfly. I know you like to see butterflies, and like to chase them, so I will tell you how to catch them without spoiling your hat. Make a small hoop of rattan, or of willow, about the size of your hat-rim. Fasten it to a handle about three feet long, and get your sister to make a small bag of mosquito-netting, and fasten it around the hoop. When you want to catch butterflies, take this hoop, creep near them, and swing your net over them.

Butterflies are among the most beautifully clothed of the insect tribes. They seem to spend a life of simple enjoyment. But where do these beautiful creatures come from? They are not the children of big butterflies. I will tell you something about these fairy beings, and then you must try to learn more by watching them, and observing their changes.

Eggs are laid by a butterfly; from these eggs caterpillars are

hatched. The caterpillar eats, grows, sheds its skin; eats, grows, and sheds its skin several times. During this stage the caterpillar is called a *larva*, which means a *mask*. It is so called because the future form of the insect is hidden in the *larva*. When the caterpillar attains its full growth it stops eating, and remains quiet as if asleep. This is called the *pupa*, or baby state. The *pupa* form of the caterpillar is commonly called a *chrysalis*. In a few weeks the *pupa* bursts its skin, and a butterfly comes forth.

Moths of all kinds pass through changes, from eggs to worms or larva and the pupa states. Moths usually enclose themselves in a cocoon during the pupa state.

Silk-worms are kinds of moth larva. See the lesson on silk, page 160.

Objects for other Lessons.—Objects suitable for other similar lessons may be chosen from the following list, and the teacher usually will be able to find the needed information to supplement such facts as may be gathered from the pupils through their personal observations:

Mosquito,	Cricket,	Ant,
Katydid,	Canary,	Fly,
Beetle,	Dove,	Horse,
Turtle,	Turkey,	Sheep,
Fish,	Swan,	Cow,
Snake,	Goose,	Weasel,
Frog,	Honey-bee,	Monkey.

SIMPLE CLASSIFICATIONS.

An exercise for leading the pupils to observe such prominent characteristics of animals as may be made a basis for arranging them in groups will be interesting and profitable. The groups of animals given on pages 200 and 201 will indicate the classes which the pupils can form by means of their own observation of animals, and by the aid of the pictures of them.

ANIMALS WITH HOOFS.

Horse,	Goat,	Buffalo,
Mule,	Cow,	Antelope,
Zebra,	Ox,	Gazelle,
Zebu,	Yak,	Chamois,
Sheep,	Deer,	Gnu.

ANIMALS WITH HORNS.

Cow,	Deer,	Gnu,
Ox,	Antelope,	Zebu,
Sheep,	Buffalo,	Musk-ox,
Goat,	Ibex,	Yak,
Moose,	Reindeer,	Eland.

ANIMALS WITH SOFT FEET.

Cat,	Fox,	Camel,	Mouse,
Dog,	Wolf,	Bear,	Rat,
Lion,	Tiger,	Rabbit,	Squirrel.

ANIMALS WITH SHARP CLAWS.

Cat,	Panther,	Eagle,
Lion,	Lynx,	Hawk,
Tiger,	Leopard,	Owl.

ANIMALS WITH LONG NECKS.

Horse,	Camel,	Llama,
Deer,	Giraffe,	Gazelle.

ANIMALS WITH LONG LEGS.

Giraffe,	Horse,	Gazelle,
Camel,	Deer,	Chamois,
Crane,	Flamingo,	Heron.

ANIMALS THAT EAT GRASS.

Cow,	Horse,	Deer,	Buffalo,
Sheep,	Mule,	Zebu,	Antelope,
Goat,	Ox,	Gnu,	Camel,
Gazelle,	Elephant,	Zebra,	Giraffe.

ANIMALS THAT EAT FLESH.

Cat,	Lion,	Weasel,	Hawk,
Dog,	Tiger,	Otter,	Eagle,
Wolf,	Leopard,	Lynx,	Owl,
Fox,	Hyena,	Jackal,	Vulture.

ANIMALS WHOSE FLESH MAN EATS.

Cow,	Deer,	Duck,	Quail,
Ox,	Buffalo,	Goose,	Pigeon,
Sheep,	Squirrel,	Hen,	Woodcock,
Pig,	Rabbit,	Turkey,	Partridge.

ANIMALS WITH WINGS.

Hen,	Canary,	Hawk,	Swallow,
Turkey,	Robin,	Owl,	Bat,
Duck,	Sparrow,	Eagle,	Wren,
Goose,	Pigeon,	Vulture,	Quail.

ANIMALS WITH FUR.

Beaver,	Mink,	Sable,
Otter,	Weasel,	Marten,
Seal,	Squirrel,	Chinchilla.

LESSONS ON ANIMALS.

THIRD STAGE.

[*Appropriate for children during their fourth, fifth, and sixth years in school.*]

When the pupils have had a year or two of such experiences in observing the habits of different kinds of animals as is contemplated by the lessons of the *second stage*, they will be fully prepared to compare the habits and structure of similar animals, and thus become familiar with their leading family characteristics.

The first lessons should commence with animals that the pupils can examine personally; as the duck, the hen, the cat, the cow, etc. In cases where several animals of the same kind cannot be examined personally by the pupils, pictures may be used as a substitute in making the comparisons as to their form and structure.

The outline of a few lessons is here given, to indicate the general plan of conducting the exercises in natural history for the *third stage*. Following these lessons are the names of several other animals, with brief statements of facts concerning them, which the teacher may use as materials in preparing lessons. In giving these lessons, it will be well for the teacher to direct special attention of the pupils to one or more of the following points in relation to each animal. That point in relation to any one which is most familiar to the pupils will indicate where the lesson on that animal may commence:

The habits of the animal, or what it usually does.
Where it is found; its mode of living.
How it moves; kind of food eaten by it.
Its structure; whether that of a bird, quadruped, fish, reptile, insect, etc.

Its shape and size.

Its covering and color.

Its uses.

How its structure adapts it to its mode of life, to its habits, food, uses, etc.

THE DUCK.

If the duck be selected as the subject for the first lesson, let the pupils be required, as an introductory exercise, to tell what they know already about the shape of the duck's body, head, neck, beak, and feet. Let them describe some of the habits of the duck—tell what it does, its uses, color, where found, etc.

Request the pupils to make further observations, that they may ascertain and report at the next lesson how many toes ducks have; what is between their toes; how they use their feet; the position of the legs on the body; whether the legs are short or long; whether their feathers hang loosely, or lap upon each other closely; what is under their feathers; about the oiling of their feathers; the use of their long necks; their broad bills, with the comb-like edges; and what is their food.

After full observations have been made by the pupils, and reported in class exercises, request them to name other birds which have similar bodies, feet, necks, and bills. Then let the pupils make observations to see how these characteristics resemble and how they differ from those of the duck, and report concerning these also to the class.

To facilitate this work of observation and comparison, the teacher may place before the class a large *picture of a duck*, and let the pupils point out each characteristic that may be seen in the picture. Then pictures representing other *swimming birds* may be shown the pupils, that they may compare the characteristics of the birds thus represented with those of the duck.

If the exercises on this subject be properly conducted, the pupils will learn that the general forms of swimming birds are—*boat-shaped bodies*, *short legs*, *webbed feet*, and *long necks;* and that all ducks, geese, swans, gulls, and many other birds, belong to this group.

Before leaving this group of birds, request the pupils to state in writing their principal characteristics, habits, uses, etc., and to give the names of all they can remember as belonging to the order of *swimming birds.*

THE HEN.

When the hen is made the subject of a lesson, require the pupils first to tell all they know about her general shape, size, structure, habits, etc.; then place before them the large picture of a *turkey*, and let them point out parts similar to those of the hen.

When they have observed that the hen and the turkey have heavy bodies, small heads, short wings, strong but not very long legs, toes nearly straight, with short, blunt nails—three front toes longest, hind toe short and higher than the others; that their beaks are short and stout—tails large; that the hen finds her food by scratching the ground; that both spend most of the time on the ground; that their food consists of grain, seeds, and insects; that they usually select some elevated position—as a branch of a tree—for a roosting-place at night; that their young are hatched from eggs;—when the pupils have given attention to these characteristics, other pictures of this group of birds (scratching birds) may be placed before them, that they may observe similar forms and characteristics in the birds represented by the pictures. The teacher may now tell the pupils a few facts about each of the birds in this group: why they are called *scratchers;* their general habits; where found; uses, etc.

When the exercises on this group of birds are finished, the pupils will know that all hens, turkeys, peacocks, Guinea-fowls, pheasants, prairie-chickens, quails, partridges, and grouse belong to the group of scratchers; and that pigeons, doves, etc., resemble those of this group in many respects.

THE QUAIL.

Did you ever hear a bird say, with a whistling voice, "Bob White—Bob White?" or "More wet—more wet!" several times in succession? Some persons think he says, "Buckwheat—buckwheat!"

Did you ever see this brownish bird, with head and feet of the shape of those of a hen, and body about the size of a chicken when its feathers begin to grow out? This bird has several names; it is called *Bob White*, or a *quail*, in the New England and Middle States, and *Virginia partridge* in the Southern States. It belongs to the *gallinaceous*, or scratching birds, and the *grouse* family.

The body, from the tip of the beak to the end of the tail, is about nine inches; wings, extended, from fourteen to fifteen inches; beak short and blunt; head small; legs bare; the front toes rest on the ground; hind one short and slender. It lives in fields and meadows; feeds on grain, seeds, and insects; makes its nest on the ground; lays from eight to ten white eggs. The young quails look like young chickens. The flesh of the quail is much prized for food.

Did you ever read the story of a man who caught two young quails and tamed them? Did the old quail find them after they became tame? Can you tell that story?

THE PRAIRIE-HEN.

This bird also belongs to the order of *scratchers*—to the *grouse* family—and is known as the *pinnated grouse;* also as the *prairie-hen.* It may be easily tamed.

It is found in flocks on the Western prairies; length of body, from tip of beak to end of tail, sixteen to eighteen inches; wings, when extended, are twenty-four to twenty-eight inches; legs covered with feathers; the hind toe higher up on the leg than the front toes. It feeds on grains, seeds, and insects. The flesh is highly prized for food. It may be seen for sale in markets during autumn and winter.

The prairie-hen can produce sounds, which may be heard half a mile or more, by inflating the air sacs under the tuft of feathers at the sides of its neck. Did you ever see a prairie-hen?

Now request the pupils to write out the chief characteristics as to structure, habits, uses, etc., of this group of birds, and to give a list of those that belong to it.

THE CAT.

After the children have stated all the facts which they have discovered by personally observing the cat, place before them a large picture of this animal, and request different pupils to point

out each characteristic part which has been noticed in their examination of the cat.

When they have thus shown that their attention has been given to the following particularities of this animal—as, round head; short ears; great changes in eyes in light and in darkness; sharp teeth; rough tongue; feelers; soft feet; sharp, hidden nails; difference in number of toes on front and hind feet—the teacher may tell the pupils the use of each of these peculiarities of structure, and add other interesting facts about the cat's habits, etc.

At a subsequent exercise place other pictures of the *cat family* before the class, that they may compare each picture with that of the cat, and notice prominent resemblances and differences. Facts about each member of the *cat family* thus shown to the pupils may be stated to them. Suitable information on this subject will be found in *Prang's Natural History Series for Children* (Cat Family), and in other books of natural history.

Before the lessons on this family are finished, the pupils should become familiar with the leading characteristics of the cat, and of other members of the family—as, the Manx cat, Angora cat, wild-cat, lynx, panther, cheetah, jaguar, tiger, leopard, lion, etc.—and able to recognize them all as flesh-eating animals with many similar habits.

Facts about the *cat* of interest to children may be found in *Lessons on Animals* for *Second Stage.* [See page 181.] Request pupils to write descriptions of members of the *cat family.*

THE LION.

After the preceding lesson on the *cat family,* it would be appropriate to give a lesson about the *lion* in a different manner from the preceding ones—the teacher giving most of the information, somewhat as follows:

A few days ago you had a lesson on the *cat family,* in which it was shown that the lion—sometimes called "king of beasts"—belonged to that family. You may call him the great-uncle of the cat. I will tell you something about this wonderful animal. His native place is in Africa; also in some parts of Asia. He likes to

roam over stony plains, dotted here and there with thickets of bushes, in which he can hide and watch for his prey to come near. The home of the lion is far from the home of man. People seldom visit the places where lions live, except as they go there to hunt wild animals.

Lions live in pairs. They are usually from six to eight feet long, and from three and a half to four feet high. The weight of one is from four to five hundred pounds. Their color is usually a tawny yellow. A mane of long hair covers the neck of the male lion. The lion has thirty teeth, which are sharp and pointed like those of the cat.

The feet and claws are also like those of the cat in form, but very much larger and stronger; and, like the cat, the lion can walk almost noiselessly. Like the cat, the lion has a rough tongue; but the rough points are much longer and harder than those of the cat. These points slant backward, or toward the mouth, and are so strong that flesh may be scraped from bones by this rough tongue.

Thus it may be seen that the structure of the lion indicates an animal of great strength and power in overcoming other animals. It is said that the lion can carry a young ox or a sheep in his mouth with as much ease as a cat can carry a rat. He cannot run as fast as a deer or a zebra, and could not get a good living by chasing his game. In the country where the lions live there are not many springs or streams of water; often the animals must go a long distance to quench their thirst. The lion finds those places where the animals which he likes for food go to get drink. Near these places he lies concealed in a thicket, watching for his prey to come along, just as the cat watches for the mouse to come from its hiding-place. Cat-like, the lion springs with a bound, and seizes its prey with his mouth and fore-paws. Sometimes it will spring twenty feet at a single bound.

When the lion seizes his prey he usually utters a terrible roar, which almost paralyzes the victim with fear; but his loudest roaring is made during the night; and in those secluded regions it must produce great fear among other animals. His roar consists of a deep-toned, moaning sound, repeated five or six times in quick succession, each time increasing in loudness; ending with an audible sigh. Sometimes several lions may be heard roaring at the same time. What a concert exercise!

Like the cat, the lion can see well at night; and during this time he goes about, while during the day he sleeps most of the time in his *lair*, which is usually in a thicket, or by the side of a rock. He is commonly seen moving about at sunset, or just before sunrise.

The lion has a long tail, with a tuft of hair at the end, like a tassel. When angry, he lashes his sides with his tail, just as a cat does when it is displeased. It possesses sufficient strength in its tail to knock a man down at a single blow.

Let the pupils write what they can remember concerning the lion.

THE DOG.

When the pupils have told what they know about dogs—their habits, food, structure, uses, and the different kinds—place large pictures of dogs before the class, and let the pupils point out and name the different kinds, their parts, etc.

Direct attention to the attachment of dogs to their masters—to their swiftness in running; their keen scent; pointed nose; smooth tongue; flesh-tearing teeth; fore feet five-toed; hind ones four-toed; thin legs; tails curved upward; and to the fact that they are found in all parts of the world.

Compare their nails, feet, and eyes with those of a cat. Dogs chase prey; cats wait for it to come near, then suddenly spring upon it. Dogs hunt by day; cats hunt at night. All the senses of the dog are well developed, especially those of smell and hearing.* Dog not strictly a carnivorous animal; when domesticated, will eat all kinds of food.

Tell stories about dogs. Let the children read stories about them and write about them.

THE WOLF.

The *wolf* is a kind of cousin to the dog. He belongs to the flesh-eating quadrupeds, and to the dog family. In general appearance he is much like the dog, and his hair is longer, but he lets his tail hang, instead of curving it upward like the dog.

The wolf growls and howls, but does not bark like a dog. Although he is cunning and ferocious, he has not the dog's noble courage. He lives in forests, hunts at night, and usually in packs. Wolves are very destructive to sheep.

Tell a story about wolves, and request the pupils to read about them at home; also to write about them.

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* See Lesson on the *Dog* for *Second Stage*, p. 185.

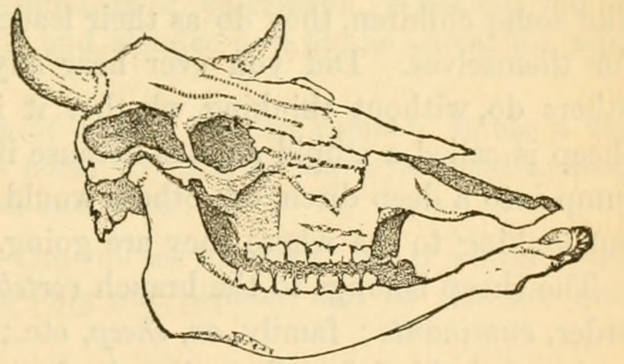
Foxes, like wolves, belong to the dog family. They have heads, teeth, and ears much like some dogs. Foxes hunt at night, but singly.

THE COW.

By requiring the pupils to state what they have observed in relation to the cow's food, her peculiar manner of eating, her feet, horns, teeth, and the several uses of the cow; by stimulating them to make further and more careful observations of cows, sheep, goats, deer, etc.; by the use of pictures, and by awakening a desire to read books of natural history—seek to make the pupils acquainted with the chief peculiarities of the *cud-chewing animals.*

Direct their attention to the following facts concerning the group embracing the cow, ox, bison, sheep, goat, yak, zebu, antelope, etc.—that these have hollow horns; feed on grass, etc.; that they chew their food twice; that they are generally timid animals, and seek safety in flight; that they have parted, or cloven hoofs. [The teacher should sketch the hoof on the blackboard.]

CLOVEN-HOOF.



SKULL OF A COW.

The pupils may also be led to notice from a sketch on the blackboard—also from observing the mouth of a goat, sheep, or cow—that they have no *front* teeth on the upper jaw; and also to notice that they get up on their hind feet first; that these animals are of great service to man; that they supply us with numerous articles for food, clothing, and other purposes, which contribute much to our comfort.

Lead the pupils to write all the facts they know about the cow and the ox at the close of the lesson.

THE SHEEP.

The sheep is so familiar to children that they will be able to state many facts which can be used by the teacher as the basis of lessons about this animal. They can tell something about their uses—their wool for clothing, their flesh for food, their skins for leather, their tallow, etc. They may also know the names and distinguishing characteristics of the **Merino**, with its large horns, small body, and very fine, soft wool; or of the **Southdowns**, with their dark faces, long necks, coarse wool, large bodies—without horns — and the excellent mutton from their flesh; or of the **Leicester**, without horns, with straight, round bodies, broad backs, and very long wool.

Direct attention of the pupils to their cloven hoofs; cud-chewing; feeding upon grass, grain, and vegetables; no front teeth on upper jaw; long, slender head; horns much curved, and rough, like ridges.

Call attention to the fact that sheep follow a leader, and that, like some children, they do as their leader does, without thinking for themselves. Did you ever hear any children say what the others do, without thinking whether it is right? The common sheep is called a stupid animal, because if one of the flock should jump into a deep ditch, the others would follow, apparently without looking to see where they are going.

The sheep belongs to the branch *vertebrates;* class, *mammalia;* order, *ruminants;* family, *ox*, *sheep*, etc.; genus, *ovis*. They get up on their hind feet first; live in flocks; their young are very playful. Did you ever see lambs play?

THE CAMEL.

Introduction by the Teacher.—Far away, across the wide ocean, in the countries called Africa and Asia, there are many large deserts of sand. In these deserts there are no trees, no soft, green grasses, no rains, no rivers, no roads, no houses, and no people living there. The sand is so fine and dry that the winds carry it about in great clouds. It is so soft that even a child would sink into it over its shoes when walking. Horses cannot travel there, because their feet would sink so deeply into the sand; besides, they would die of thirst and hun-

ger before they could reach a place where food and water might be obtained. Yet the people who live near these pathless deserts often want to cross them, and to carry goods on these dreary journeys.

God has created an animal which is fitted to live in just such a country. It is so formed that it can travel in soft sand, and live a long time without food or water. Now I will show you a picture of that wonderful animal, and we will talk about its structure and habits. [Showing a picture of a camel.] Here is the picture. Can you tell the name of this animal?

Its Feet.—Now look at its feet. Are they like the feet of a horse? The feet of the camel are long and broad, and soft and tough. They are broad and soft, and become so much spread out under the weight of the animal that they sink but little in the sand; they are so tough that the sand does not hurt them. The small, hard foot of a horse would sink so far in the sand that the horse would soon become exhausted; the cushion-shaped feet of the camel prevent its sinking, and thus enable it to travel a long distance without fatigue. Its feet would become sore on stony roads, and they are not fitted for travelling in wet places. The camel was made for a dry and sandy country.

Its Legs.—Do you see the legs of the camel? What can you say of them? They are long and slender, and fit the camel for rapid travelling.

Its Neck.—What sort of a neck has the camel? It has a very long, curved, and slender neck. This is to allow its head to reach the ground easily for food and water.

Its Head and Ears.—Can you see its ears? Has it a large, round head? No; its head is long and slender, and its ears are quite small.

Its Nostrils.—The nostrils of the camel are so formed that it can close them at will. This enables it to keep out the drifting sand, and prevents a great deal of pain and injury to the animal. Its sense of smell is very acute; it can smell water at a great distance, and by this means it sometimes saves the life of its master.

Its Size and Shape.—The body of the camel is about the size of a horse, but its back resembles an arch instead of being nearly straight, like that of the cow or horse. It is generally taller than a horse, being from five to seven feet high.

Its Hump.—Is the back of the camel like the back of a horse or a cow? No; it has a *hump* on its back. This hump is a mass of fat. When the camel is fat, the hump is very large; but when the

animal is lean, the hump is small. When the camel, on its long journey across the desert, is obliged to subsist on a very small allowance of food, or even to go without food, the fat of the hump supplies nutriment. Its substance is absorbed and taken into the general circulation, and thus supports the animal to the end of its journey, or until it sinks under privations which no other animal could have borne for half the time.

Its Food.—What did I say about the deserts across which the camel travels? They contain no trees, and no green grass. In some places, however, there may be found prickly shrubs and a dry, coarse grass, but only in small spots. No horse or donkey would eat such food; yet the camel seems quite contented if, when it stops to rest for the night, it can find even such coarse food as thorny shrubs and dry, coarse grass. Its master, however, usually takes along with him dates and beans, and a few of these seem to satisfy its hunger when a regular meal cannot be had. The camel chews its cud, like the cow, the sheep, and the goat.

Its Drink.—You remember I told you that there were no rains and no rivers in the desert. Frequently it is necessary to travel ten or twelve days without finding a spring or a well of water. During all this time the camel must go without drinking. Here we see the beneficence of the Creator in the formation of an animal so well adapted to meet the wants of man. The camel has four stomachs; one of these is provided with a great number of water-cells; and before setting out on a journey he drinks a great quantity of water, filling all of these cells. The water thus stored up in its stomach lasts for a long time; and whenever it desires to do so, the camel can make use of a little of this water to moisten its food and refresh itself. By this means it can travel a long distance without suffering from thirst.

Its Habits and Uses.—When kindly treated, the camel is gentle, patient, and easily taught. It kneels down to receive its load, and kneels down again to have it removed at night; also to let its master mount and dismount. At night it lies down by its master's tent. In the morning it comes at his call to receive its load.

The camel furnishes milk for its master's family. It carries them on its back during the day, and often its side serves them as a pillow at night. Its body is a shelter against the whirlwinds of sand, and in battle an intrenchment behind which the family and their property are protected. The hair of the camel supplies materials for clothes and tents; of its skin are made sandals for the feet, saddles upon which to ride, buckets for water, and large bottles for car-

rying water to supply the traveller on his long journeys across the desert. Its flesh is used for food.

The camel may be regarded as one of the most useful of animals. The Arabs consider it as a "gift of Heaven," a sacred animal, without whose assistance they could neither travel, traffic, nor subsist. They call it the "Ship of the Desert," for it bears them safely over the pathless wastes of Arabia and Northern Africa, under privations which no other animal could endure.

The usual load of a camel is from six to eight hundred pounds; and with this weight on his back he will travel from forty to fifty miles in a day. But the camel that is trained for speed will bear its master and his food on its back, and travel from seventy to one hundred miles in twenty-four hours, and continue at this speed for several days in succession. It sometimes performs a journey of seven hundred miles.

Training the Young Camel.—When the Arab desires a camel for speed, he takes it when quite young, folds its limbs under its body, and while in this situation on the ground he loads its back. This weight is removed only to be replaced by a heavier one. Instead of allowing it to feed at pleasure and drink when thirsty, he regulates its meals and drink, and gradually trains it to travel long journeys, and diminishes at the same time the quantity of its food. When it has thus acquired strength and endurance, it is trained to move with speed. In this manner it becomes robust and fleet, and capable of great endurance.

Review the Lesson. — When the preceding facts relative to the camel have all been given, the teacher should require the pupils to tell all they can remember about this animal. At first, any pupil that can think of anything to say may raise a hand, and the teacher proceed to call upon them, one at a time, to say what they remember, care being taken to have as little as possible repeated. Subsequently the pupils may be called upon in turn, and more system be required in the order of stating the facts.

Afterward they should be directed to write all they can remember about the camel, and state what group of animals it belongs to.

In this connection the attention of the pupils may be directed to the form and habits of the Giraffe, also to those cud-chewing animals found in South America—the Llama and the Guanaco—which belong to the hornless ruminants.

THE DRAGON-FLY.

Introduction by the Teacher.—Most children are very much frightened when they see a large insect flying about which they call a "darning-needle," or the "devil's darning-needle." They think it can sting or bite them, or get in their ears. Some older persons have a dread of it; so that it has many enemies, and but few friends. Now, before looking at this insect or its picture, and before talking about its habits and life, let me assure you that there is no cause either of fear or dislike for this harmless creature, which is really very useful to us in destroying mosquitoes and flies. It cannot bite, or sting, or poison, or do any injury to any person. It is just as harmless as a butterfly. When you have learned more about this insect, you will understand how useless are the fears which children have of it; and I hope you will learn also to welcome its restless, rapid movements in pursuit of mosquitoes and flies, through gardens, over ponds, and even in the house, rather than scream and run away from it. Now let us examine this *dragon-fly*—that is the real name of this insect. What can you say about it?

Children. It has four wings. It has a long, slender body. The shape of the body is cylindrical. It has a large head. Its wings are oblong. They are very thin, and almost transparent. The wings look something like net-work. It has ten rings around its body. It has six legs. It has two large eyes. It has two feelers.

Teacher. Very well said. See its great head, large eyes, short neck, its hunch-back, and long, slender body, its gauze-like wings, and its beautiful colors! I told you that it is useful to us in destroying mosquitoes. It catches them with its feet while flying, and devours them. If a few dragon-flies were shut up in a room for a short time, they would effectually rid it of all mosquitoes and flies.

Eggs of the Dragon-fly.—The dragon-fly alights upon stems of rushes or other water-plants, and deposits its eggs below the surface of the water, frequently attaching them in a bunch to a stem or leaf. These eggs are hatched during the warm weather of summer by the heat of the sun.

The Larva or Grub.—At first the larva or grub of the dragon-fly resembles a bug, with large eyes and six long legs. In this state it is very active, walking over the bottom of the pond of water it inhabits, or swimming in search of the larva of mosquitoes and other insects, of which it devours great numbers. It thus aids in diminishing and removing from ponds and swamps, and also from our fields, gardens, and houses even, swarms of blood-sucking insects.

The Pupa.—When the larva has outgrown its skin, this splits open at the back, and the insect crawls out, thus changing from the larva to the pupa state. It still continues to live in the water, remaining there in all some ten or twelve months. As before, its food is chiefly the larva of mosquitoes.

The Dragon-fly.—When the pupa has grown too large for its skin, and is about to change into the full-formed dragon-fly, it climbs up the stem of some plant near the surface of the water. While it remains there, its skin again splits open at the back, and the dragon-fly emerges slowly. For an hour or two it remains quiet, with its soft wings motionless. Soon the surface of the body dries and hardens, and at length the full-formed dragon-fly expands its wings and rises into the air, henceforth to live in a new world, although its existence in this state lasts but a few weeks. It is by far the most powerful flier among insects. It can fly in all directions with equal facility, forward and backward, and sidewise, to the right or left.

While it was an inhabitant of water, it devoured the young of mosquitoes; now it pursues the full-grown mosquito on the wing with relentless energy. From the moment of its birth to the hour of its death it riots upon baneful insects; thus its whole life is a continued good to man. It seems to have been sent into the world by a kind Providence to prevent too great an increase of those insects which are most annoying to man.

Teacher. Now I will write on the blackboard the names of the parts of the dragon-fly, and of the shape of each; also some other facts. Then I want you to describe the dragon-fly, telling all you can remember about it.

THE DRAGON-FLY.

Its Parts.	Shape.	Facts.
Body	Cylindrical	Its food is mosquitoes and flies.
Wings	Oblong	It is useful to man, and perfectly harmless.
Legs	Crooked	It belongs to the insect tribe.
Head	Oblong	Its body is divided into three parts.
Eyes	Oval	
Feelers	Curved	

Now request the pupils to write an account of the dragon-fly. Ask them to watch the movements as it flies about ponds, gardens, and other places, in pursuit of food. Tell them also to catch a dragon-fly and examine its wings, head, and body.

THE OSTRICH.

Introduction by the Teacher.—I am now going to talk with you about the *largest* bird, the *tallest* bird, and the *swiftest running* bird in the world. But first I will show you a picture of this remarkable bird, and you may tell me all you can about its shape and size, and its *name*, if you know what it is. Here is the picture. [Showing the picture of an ostrich. The children should be required to answer singly; and they might give the following and other similar replies:]

Children. It is an ostrich. It has a long, slender neck, and a small head. It has long legs. It has only *two toes* on each foot, and one is so much shorter than the other that it does not look much like a toe. It has a large body. It has short wings. Its colors are black and white.

Teacher. Ostriches are found in the sandy countries of Asia and Africa. They are usually seen in flocks or droves. Frequently they do great injury to grain by entering the fields, and destroying the ears so completely that nothing is left but the bare straw.

I told you that this is the largest and tallest bird in the world. You may better understand how large it is when I tell you that the head of the ostrich is as high as your head would be were you sitting on the back of a tall horse. It is usually from seven to eight feet in height. You remember that I also told you that this is the swiftest running bird in the world. No other animal can run so fast as the ostrich. A fast-running horse, you know, can run a mile in about three minutes; yet a horse cannot overtake an ostrich by following its track. No hunter on the fleetest horse could capture this bird if it should run in a straight line; but the ostrich always runs in curves; and as soon as its course is ascertained, the hunter takes a straight line, passing over a much shorter space, intercepts and shoots the bird as it dashes past him. While running, the ostrich uses its short wings as oars to increase its speed. These are too small for flying. The Arabs hunt the ostrich for its beautiful plumage. The feathers of its tail and wings are long and soft, and are much used as ornaments for ladies' bonnets. These feathers are very valuable; in their unprepared state they cost from eighty to one hundred dollars per pound. The skin of the ostrich is very thick and tough, and is used for leather. Some warlike tribes in Africa use the ostrich's skin for shields and other defensive armor. Its flesh, which is coarse, and somewhat like that of a tough turkey, is used for food.

The eggs are considered a great delicacy by the natives. They

cook them in hot ashes; and, through a hole made in the end of the shell, they stir the contents round until the substance becomes thick like an omelet. The weight of an egg is about three pounds.

The nest of the ostrich is simply a hollow scratched in the sand, in which are deposited from twenty to thirty eggs. Besides these, there are several eggs, in separate small hollows in the sand, around but not far from the nest. These eggs are intended as food for the young ostrich when first hatched. In the tropical regions the eggs are buried in the sand, and hatched by the heat of the sun; but in cooler climates the male and female take turns in sitting on the eggs. They defend their young with much courage. When hunted by dogs and overtaken, they will fight desperately. The ostrich has been called the "camel-bird."

You said the ostrich has a long, slender neck and a small head. The neck and head are covered with hairs instead of feathers. The eyes are protected from the intense heat of the sun and the fine sand of the desert by a peculiar lid, which can be drawn down at pleasure.

Is the beak of the ostrich like that of a hen or that of a goose?

Children. It is most like that of a goose?

Teacher. The ostrich is a great eater. Its usual food embraces the tops of shrubby plants, grains, seeds, etc.; but it will swallow greedily rags, leather, wood, stone, nails, keys, or pieces of money.

The Ostrich Family.—Besides the *African Ostrich*, there are four other kinds of large, running birds. All of these are remarkable for the *great size of their bodies; their long, slender necks; their long and strong legs; their very short wings; their great speed.* They are called the *American Ostrich*, or *Rhea;* the *Cassowary;* the *Emeu;* the *Apteryx.*

The American Ostrich.—The American ostrich, or rhea, is found in Brazil, South America. It is much smaller than the African ostrich; has three toes on each foot, all furnished with claws. It is of a gray color. Its feathers are of but little value.

The Cassowary is found in the large islands of the south-eastern part of Asia. It is about five feet in height; has three toes on each foot, provided with nails. Its covering or feathers resembles the hair of a horse's mane. The head is armed with a kind of helmet, composed of a horny substance. In running, it can outstrip the swiftest greyhound. Like the African ostrich, it will swallow almost anything that is offered to it which is not too large to pass down its throat. The color of the eyes is a bright yellow. It defends

itself by kicking like a horse, or running forcibly against its enemy, knocking it down, and treading it under foot.

The Emeu.—The emeu is found in Australia. It is from five to seven feet in height. It is very much like the African ostrich in form and habits, but differs much from it in other respects. It is exceedingly shy, and it is very difficult to get within gunshot of one. The covering of the body, instead of being soft, beautiful feathers like those of the ostrich, resembles thin strips of whalebone, or coarse, long hair. Its food consists of fruit, roots, and herbage. Its eggs, like those of the ostrich, are used for food by the natives. The male bird sits on the eggs, hatches the young, and takes the chief care of them.

The Apteryx.—The apteryx is an inhabitant of New Zealand. It is about two feet in height, and of a dark-brown color. It runs with great rapidity when pursued, and takes refuge in the holes of rocks or among the roots of trees. Its bill is very long. It drives this into the soil to gather earth-worms, which constitute its principal food. This bird lives in pairs, constructs a rough nest, and lays a single egg about the size of that of a goose. The flesh is esteemed by the New Zealanders, and they use its skin and feathers for cloaks.

All of these birds belong to the *Cursores*, or short-winged, running birds.

NOTES FOR LESSONS IN NATURAL HISTORY.

To insure success with lessons in natural history, and prepare pupils for understanding *classifications*, the teacher must be able to guide them so that they shall observe those distinctive and important characteristics of animals by which the classification is determined. Facts that are commonly needed by teachers for this purpose are not readily accessible to them; and the purpose of these *Notes for Lessons* is to add to the previous lessons a sufficient variety of such distinguishing facts about other animals as will enable any good teacher to conduct a series of lessons on this subject with profit to the pupils.

In the following notes may be found most of those characteristics that distinguish the animals mentioned, and indicate the class to which each belongs. The common descriptions of animals and interesting stories concerning them may be easily obtained, by both teacher and pupils, from the books on natural history within their reach; and to some extent from the reading books used in school. It is intended that the pupils and teacher shall obtain such information from books, in addition to what they may gather from personal observation, and each contribute something of interest concerning the animal that is made the subject of a lesson; also that the facts stated in these notes shall be incorporated with the information thus gathered, and the lessons thereby made complete.

The most important distinguishing facts, together with much interesting information relating to the habits and structure of the several animals belonging to the groups

known as *swimming birds; wading birds; scratching birds; birds of prey; cat family; cow family*, or hollow-horned ruminants; *deer family*, or solid-horned ruminants; *camel family*, or hornless ruminants; *squirrel family*, or rodents; and *weasel family*, fur producers—may be obtained, for notes of lessons, from *Prang's Natural History Series for Children*,* and from the *Manual for Prang's Natural History Series for Schools*,† which embrace descriptions and illustrative colored pictures of more than one hundred animals.

The teacher will also find important facts to aid in giving these lessons in an article following this, on "Classification of Animals," page 229. The facts given there will show the relations of different animals to each other, and the classes to which they belong, thus supplementing these notes.

As a useful closing exercise for the lessons on an animal, request the pupils to write the most important facts relating to that animal, give its classification, and mention its chief uses, or add a short story about it. Let these summaries of the lessons be read before the class, and corrections made by the pupils under the guidance of the teacher, thus combining, with the knowledge of natural history, practical instruction in language and composition.

THE HORSE.

The largest and most beautiful of the single-hoofed quadrupeds is the horse. It has a long head, long neck, small pointed ears, loose mane, long, hairy tail, legs long and slender, and is adapted to speed. It belongs to the class, mammals; order, hoofed-quadrupeds; family, horse. It feeds on grass and grains; is very scrupulous in the choice of its food; does not chew its food a

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* Prepared by N. A. Calkins and Mrs. A. M. Diaz.

† Prepared by N. A. Calkins. Published by Messrs. L. Prang & Co., Boston, Mass.

second time. The horse gets up on its forefeet first. It is found in all countries; forms a strong attachment to other horses and to man; its uses are well known.

The Pony is a very small horse, and is a native of the Shetland Islands.

Request the pupils to give the names and uses of different kinds of horses.

THE ELEPHANT.

The elephant belongs to a group of *thick-skinned* animals. It is a quadruped; a native of Asia, also of Africa. **The Asiatic Elephant** has a long head, concave forehead, *small ears*, and *short tusks;* **the African Elephant** has a round head, convex forehead, *large ears*, and *long tusks.*

The skin of the elephant is very thick, rough, and nearly naked; the body is very large and heavy, being from ten to fifteen feet long, and seven to eight feet high; neck short and stout; head large; eyes small; has two tusks projecting from the sides of the mouth; has a very large and long nose, called a trunk or proboscis. This is an organ of smell, of touch, of feeling, and a weapon of defence. It can pick up very small articles of food with the finger at the end of the trunk, and place them in its mouth. It can draw up water with its trunk, and pour it into its mouth or throw it over its body. The Asiatic elephant may be tamed, and made useful in many ways. The African elephant cannot be easily domesticated.

Let the pupils relate or write interesting stories about elephants, their tricks, uses, etc.

THE RHINOCEROS.

This animal belongs also to the thick-skinned quadrupeds; indeed, its skin is naked, and so thick and hard that it will resist an ordinary lead bullet when fired from a rifle. The skin of the **Asiatic Rhinoceros** is so stiff that folds or plaits are necessary

near the principal joints of the body to allow the animal to move its limbs freely.

The rhinoceros is from ten to twelve feet long, and from five to seven feet in height. Its upper lip is long and pointed, and is used in picking up its food. It feeds on grass, branches of trees, and other vegetable substances. It lives in shady forests on the marshy borders of rivers and lakes. It has a horn on its nose, composed of horny fibres, like coarse hair. This grows from the skin of the nose, and is not attached to the bone of the head. This horn is sometimes three feet in length, and is a powerful weapon of defence.

The African Rhinoceros has two horns on its nose—one shorter than the other; and its skin is comparatively smooth, and without the heavy folds found on those of Asia.

This animal moves about most after sunset, and spends the day in sleep. It wallows in the mire to protect itself from bites of troublesome insects that get under the folds of its skin.

THE PIG.

This well-known quadruped is found in all parts of the world. It has cloven hoofs, *but does not chew its cud;* eats vegetables, roots, grains, and flesh; is greedy and filthy in its habits; has a tapering, pointed head, with nostrils at the end of its snout; has a flexible rim at the end of its nose or snout, suitable for rooting up the ground, which it does in search of food. Its flesh is called pork, bacon, ham, and is used for food; its fat is called lard, and is used for cooking. The pig is covered with coarse bristles; its skin is thick, and is made into leather, from which saddles are made.

THE PORCUPINE.

A quadruped, about two feet long, that feeds on leaves, bark, corn, fruit, and other vegetables; head thick; eyes small; muzzle blunt; belongs to the family of gnawers; burrows in stony soil; limbs short and strong; feet have thick, strong nails, adapted to digging; tongue rough; skin covered with spines or quills, from

one to four inches long; when irritated, it erects these spines as an armor of defence; it usually remains in its burrow during the daytime, and comes out for food at night; it sleeps during cold weather. The crested porcupine of the Old World has spines, or quills, from eight to twelve inches long, and about the size of a goose-quill.

THE RAT.

Show picture of rat and mouse. Let pupils mention their resemblances; observe that both are gnawing animals; that they are timid, but defend themselves by biting when unable to escape by running away. They feed chiefly on nuts, grains, and other vegetable food; eat flesh when forced by hunger; live in holes about dwellings, barns, etc.; sit on hind feet, and hold food in front paws when eating; have chisel-shaped teeth; long tails, without hair; some kinds live in banks of streams, where they feed chiefly on roots.

The rat is a mammal; belongs to the group of rodents; family, rats; is noted for its burrowing habits; will make its way by digging and gnawing through almost any substance, except stone and hard metals. It lives in colonies; is very destructive, and difficult to destroy. It avoids pine tar; hence paper on which a thick coating of pine tar is spread, placed over a rat-hole, will keep the rat from entering the hole as long as the tar remains fresh. The Norway, or common brown rat, finds its way to every part of the world where man makes his habitation.

THE SEA-LION.

This animal is found on the shores of the Northern Pacific Ocean; it is a mammal, amphibious and carnivorous, and belongs to the family of *eared-seals*. It is from ten to fifteen feet long; weighs from 1000 to 1800 pounds; color light brown; shape of head somewhat like that of a dog; voice loud, with repeating sounds resembling the rapid baying of a hound. It moves awk-

wardly on land; has fin-like feet, adapted to swimming; feeds chiefly on fish.

The three families—*common seal*, *sea-bear* or *fur-seal*, and *walrus*—belong to the same order.

THE WHALE.

This is the largest of living creatures, being from fifty to seventy feet long, and more than thirty feet around its body. *It is not a fish*, although it lives in the water and swims like a fish. It cannot breathe under water, and would drown if it could not come to the surface to get air. The whale breathes by lungs, through nostrils which are situated at or near the top of the head. These nostrils generally unite in a single opening at the surface, called the "blow-hole," which may be closed at the pleasure of the animal, so as to keep out the water as the whale dives below the surface.

The whale can remain under water for a long time without breathing; but it usually returns to the surface in ten or twenty minutes, when it blows a column of spray from its nostrils several times, in alternation with inhaling fresh supplies of air, and then disappears again. Whales have warm blood, smooth skin, beneath which there is a layer of fat, called "blubber," from ten to twenty inches thick. This substance is elastic, and, being lighter than water, it contributes to the buoyancy of these great animals. The body of a dead whale will float while the blubber remains on it, but when this is stripped off the carcass sinks. Sometimes from twenty to thirty tons of blubber are taken from a single whale, and from which one hundred and fifty to two hundred barrels of oil are obtained.

Whales belong to the class *mammalia;* order, *cetacea.* The *right-whales* are found chiefly in the waters of the far-Northern and far-Southern oceans. The *sperm-whales* are found in warmer regions of the ocean. The kinds that are most valuable are the **Sperm-whale**, and the **Right** or **Greenland Whale.** The sperm-whale has teeth, and feeds on small fish, squids, or cuttle-fish. The Greenland whale has no teeth; but from the sides of its up-

per jaw are suspended layers of whalebone [see pages 155, 156], which enable this animal, as it swims back and forth through shoals of shrimps, small crabs and mollusks, and other minute marine animals, scooping them up with its immense mouth, to strain out the water and retain its food. The head of this whale is about one-third the entire length of the animal.

The young whale is called a calf. The mother takes great care of it, sometimes carrying it on her tail as she swims. She remains near it when in danger, and will even lose her own life in its defence.

Whales, *dolphins*, *porpoises*, and *narwhals* belong to the same order of animals.

THE WOODPECKER.

This bird is commonly classed with the climbing birds, because two of its toes are turned forward and two backward, and its habit of climbing on the trunks of old trees. It is included in the order *Picariæ*, and family *picidæ*, or woodpeckers. The red-headed woodpecker has a back of glossy blue-black; head, neck, and breast of crimson; under parts, pure white. Length is about nine inches; extent of wings about seventeen inches; bill strong and sharp-pointed; tongue long, sharp, armed near the point with a barb, and may be extended several inches beyond the bill. This bird moves about the tree, in climbing, with its head upward. It taps on the bark of the tree to find the location of an insect; then cuts a hole through the bark to the grub, and thrusts the barbed tongue into the grub, and then pulls it into its mouth. The number of insects and larvæ which these birds thus destroy is incalculable; and thereby they do great good. Their boring does not injure the trees as much as the presence of the insect does when it is left to hatch out.

The woodpecker builds its nest in holes which it makes in dead trees. These holes are often excavated to a depth of several inches below the opening. This bird has great force in its neck and head. The eggs are nearly round, and of a pure white.

THE CUCKOO.

The yellow-billed cuckoo belongs to the order *Picariæ*, and family *cuckoo*. The members of this family feed on insects, and are distinguished by their cry, which is most frequently heard before a rain; hence the cuckoo is sometimes called the "rain-crow." This American bird builds its rude nest of twigs in the fork of a tree, and hatches its own young. **The European Cuckoo** does not build a nest; it lays its eggs in the nests of other birds, and leaves them to be hatched by these foster-parents. It is common for the young cuckoo thus hatched to crowd the young of the other bird out of the nest, thus obtaining more room, and all the food.

THE WHIPPOORWILL.

This bird belongs to the order *Picariæ;* family, *night-jars*, and the group of screeching birds. It is well-known by its loud, whistling cry of "whip-poor-will;" but it is seldom seen, as it is nocturnal in its habits. It sleeps in the daytime on a fallen trunk of a tree, or on a low branch, and sits, while sleeping, with its body parallel to the trunk or limb, instead of crosswise on the branch, as birds usually sit. Its strange notes are heard during the evening. It feeds on insects, which it catches during the evening twilight.

It has a wide mouth, which is fringed with stiff bristles, and moistened with a glutinous substance; these aid in catching the insects. The length of this bird is about ten inches; the wings, when extended, are about nineteen inches.

THE KINGBIRD.

The *kingbird* is about eight inches long, of a dark ash color on the back, white underneath, and tail tipped with white. This well-known bird, also the *crested flycatcher* and the *phœbe-bird*, belong to that group of perchers called singing birds, but whose voices are harsh. They all belong to the family of tyrants, because of their bold and cruel habits.

They are rapid in flight, have bills adapted to catching winged

insects, and they live entirely upon insect food. They usually perch on some prominent place, wait for a passing insect, toward which they dart suddenly, seize and swallow it, and return to their waiting-place.

The Kingbird destroys thousands of injurious insects for every honey-bee that it kills. It will attack hawks, crows, and even eagles, and drive them away, during its breeding season in May and June.

The Great Crested Flycatcher is somewhat larger than the kingbird. It feeds on insects, much in the same manner as the kingbird. It has a loud, harsh voice, and quarrelsome habits. Its color is olive-brown on the back, yellow on the under parts. It sometimes uses cast-off snake skins in building its nest.

The Phœbe-bird, or **Pewee**, is also a flycatcher. Its color is an olive-brown above, yellowish on the under parts. Its voice is soft and somewhat drawling, and its notes sound like "phe-be," or "pe-wee;" hence its name.

THE SPARROWS.

There are several kinds of sparrows, all of which belong to the group of *perchers* known as *singing birds*. They are classed with the family of *finches*, which is the largest family known in America. It includes about one-eighth of all our birds, and numbers about five hundred species. The size and general appearance of these birds are well known. Their chief food is insects, and they are of great service in destroying vast numbers of these enemies to vegetation.

The Song Sparrow—a well-known and pleasing songster—is one of the harbingers of spring. It builds its nest in a low shrub, and feeds upon insects. It is about six inches in length.

The Chipping Sparrow, or chip-bird, builds its nest on very low bushes, or in a bunch of grass. Its nest is made of fine, dry grass, and lined with cow hair. The eggs are four or five in number, greenish-blue and speckled. It feeds on insects. This bird is familiar in the fields and gardens.

The English Sparrow, which was imported to this country a few years ago from England, has become naturalized in large cities and towns, where it has proved very beneficial in destroying the canker-worm that infests our shade trees. This bird multiplies rapidly; is very belligerent; remains all winter in our cities. Fears are entertained that this sparrow will drive away many of our native birds.

The Snow-bird belongs to the order of *perchers*, family of *finches*, genus *Junco*. It somewhat resembles the sparrow, but it belongs to a different genus. It is common in the United States from October to April, but spends its summer far to the north, among mountains, where it raises its young.

The Snow-bunting has a lighter plumage than the snow-bird. It spends the summer in the northern parts of North America, and visits the United States in flocks during winter.

Other Lessons.—Similar lessons may be given on other classes of animals, embracing *insects*, *fish*, *reptiles*, etc.

CLASSIFICATION OF ANIMALS.

Classification changes facts into knowledge. Facts become useful when their relations are discovered, and they are associated in groups according to their relations. The ability to group kindred facts together, so that the result shall be practical knowledge, comes from proper experience in distinguishing similar forms, qualities, conditions, and relations in several objects. The animal world supplies the young with abundance of objects and conditions for gaining ability to learn the relations existing between facts, and to group and classify them. This field is one of great importance to the teacher, and of lasting value to the pupil; but, unfortunately, its practical utility as an educational means is too little understood. The following classifications are designed to aid in bringing this subject, in its relation to animals, within the reach of every teacher.

It often happens that a teacher wishes to know in what branch, class, order, family, or group of animals a given one belongs, when the works on natural history necessary to give the desired information are not within reach. At such times the following classified lists of animals, giving the prominent characteristics of each branch, class, order, group, family, etc., will be found exceedingly helpful to teachers (who are not expected to be as well informed on these matters as a professor of natural history). The teacher will be able, by an intelligent examination of these lists, to avoid many mistakes in giving lessons on animals; and the pupils will be saved from false impressions in relation to them. But let it be distinctly understood, however, that this classification of animals is given here espe-

cially *for the personal use of teachers*, and not as lessons for young pupils to learn, although the facts contained herein may be used in their appropriate connection in lessons about animals.*

Animals are divided into **branches**. The branches are divided into **classes**. The classes are divided into **orders**. The orders are divided into **families**. The families are divided into **genera**. The genera are divided into **species**. A species is composed of **individuals** that are essentially alike.

BRANCHES.

Animals may be divided into five branches:

I. VERTEBRATA	Animals that have a **backbone**, or an internal bony framework, as *man*, *horse*, *cat*, *birds*, *snake*, *alligator*, *frog*, *fish*.
II. ARTICULATA	Animals the bodies of which are composed of **segments** or **rings**, placed one behind the other in a symmetrical, jointed form, as *ants*, *flies*, *spiders*, *grasshoppers*, *lobsters*, *centipedes*, *bugs*.
III. MOLLUSCA	Animals that have **soft, sack-like bodies**, without joints or bones, as *snails*, *slugs*, *oysters*, *cuttle-fish*, *squid*.
IV. RADIATA	Animals that have parts of their bodies arranged around, or **radiating from a centre**, as *star-fish*, *coral*, *jelly-fish*, *sea-urchins*, *sea-slugs*, *sea-lily*, *sea-fan*.
V. PROTOZOA	Animals whose bodies consist mainly of **gelatinous matter**, without muscles, nerves, or digestive organs, yet take and assimilate food, grow and multiply. They belong to the lowest verge of animals, as *sponges*, *infusoria*.

* For further facts about families and individual animals, and for additional information as to the manner of giving lessons on this subject, teachers are referred to the *Manual for Prang's Natural History Series*, published by L. Prang & Co., Boston, Mass.; also to *Comparative Zoology*, by James Orton, published by Harper & Brothers.

CLASSES—VERTEBRATES.

The branch I. VERTEBRATA *is divided into five* classes, *as follows:*

I. MAMMALIA	Animals that have breathing organs in the form of lungs; blood, warm; heart, four cavities; young produced alive, and nursed by the mother; skin usually has hair, either on a part or the whole of the body, as *man*, *monkey*, *bat*, *quadrupeds*, *whale*, *sea-lion*, *dugong*.
II. AVES (BIRDS)	Animals that have breathing organs in the form of lungs, but connected with other air receptacles; blood, warm; heart, four cavities; young hatched from eggs; skin covered with feathers.
III. REPTILIA	Animals with breathing organs in the form of lungs; never breathe by gills; blood, cold; heart, usually three cavities; young usually produced from eggs; skin covered with scales or plates, as *alligator*, *turtle*, *lizard*, *snake*.
IV. AMPHIBIA	Animals with breathing organs, in the young, in the form of gills only, but in the full-formed animal in the form of lungs alone, or of lungs and gills; blood, cold; heart, in young, two cavities; in adult, three cavities; young produced from eggs; skin usually naked and smooth, as *frog*, *toad*, *tadpole*, *salamander*, *newt*, *siredon*.
V. PISCES (FISHES)	Animals that have breathing organs in the form of gills; blood, cold; heart, usually two cavities; young produced from eggs; body generally covered with scales, sometimes naked, as with *eels*.

CLASSES—ARTICULATES.

The branch II. ARTICULATA *is divided into the following* **classes:**

I. INSECTA . . .	Animals whose **bodies are divided into three parts**—head, middle-body or thorax, hind-body or abdomen; have six legs attached to the thorax; usually have two or four wings; breathe through a row of small openings on each side of the body; blood, colorless; hatch from eggs, usually to a larva state, in which growth takes place, then changes to the adult state, or full-formed insect, after which they do not grow, as *flies*, *bees*, *moths*, *butterflies*, *locusts*, *dragon-fly*, *musquito*, *beetle*.
II. MYRIAPODA .	Animals **with many feet**, whose bodies are divided into segments so similar that the thorax and abdomen are not easily distinguished; they are worm-like in general appearance; breathe through air tubes in sides of body, as *earwig*, *centipede*, *thousand-legs*.
III. ARACHNIDA .	Animals whose **bodies are divided into two parts**—head-body, and abdomen; have four pairs of legs; six or eight eyes; no wings; breathe through little tubes from their sides connected with air sacks in the body; hatch from eggs; change or shed skin six times as they grow to maturity, as *spiders*, *scorpions*, *ticks*, *mites*.
IV. CRUSTACEA .	Animals whose **bodies are covered with a crust or shell**; having jointed legs; breathe by gills; blood colorless; usually live in water; hatch from eggs; shed their shells as they grow; have power of repairing themselves (if a leg be lost, a new one grows in its place), as *lobsters*, *crawfish*, *shrimp*, *sand-fleas*, *barnacles*.

V. ANNELLIDA	Animals whose **bodies are composed of a succession of rings,** worm-like, without legs or wings; each ring usually contains a breathing and circulatory apparatus; some breathe by the skin, as *earth-worms* and *leeches;* some breathe by tuft-like gills, as *sea-worms.* This class includes all *real worms, earth-worm, tape-worm, trichina, hair-worm, leech, wheel-animalcule.*

CLASSES—MOLLUSKS.

The branch III. MOLLUSCA *is divided into the following* **classes**:

I. CEPHALOPODA	Soft-bodied animals with a head, to which are attached eight or more arm-like appendages; have two prominent eyes; two stout, horny jaws; rasping tongue; body naked, or protected by a shell, as *cuttle-fish, octopus, argonauts, squids.*
II. CASTEROPODA	Soft-bodied animals, unsymmetrical in form; organs not in pairs; move by one foot; usually breathe by gills [land-snails and slugs breathe by lung]; two eyes on long, horn-like feelers; young hatched from eggs, as *slugs, snails, whelk, limpet, sea-slug, cowry, cone-shell, periwinkle.*
III. LAMELLIBRANCHITA .	Soft-bodied animals without heads; breathe by four plate-like gills; shell equivalved; hinge of shell on the back of the animal, as *oyster, clam, mussel, cockle, razor-shell, scallop.*

IV. Brachiopoda . . .	Soft-bodied animals, with two long arms extending from the sides of the mouth, by means of which they cause a current of water, and thus secure their food; without gills; all *marine animals.*
V. Tunicata	Soft-bodied animals, without head, feet, arms, or shell—*found in seas.*
VI. Polyzoa	Minute animals, living in clusters, sometimes in a plant-like form; are both marine and fresh-water animals.

CLASSES—RADIATES.

The branch IV. Radiata *is divided into* classes, *as follows:*

I. Holothuroidea .	Worm-like *sea-slugs*, with soft, elongated body, tough, contractile skin, with feathery-like arms around the mouth.
II. Echinoidea	A globular animal, encased in a thin shell covered with spines, that lives near the shore, in rocky holes or under sea-weed, as *sea-urchin* or *echinus.*
III. Asteroidea	An animal with a leathery skeleton, covered with very small plates of shell-like substance, having five or more arms radiating from it, as *star-fishes.* The red spots at the end of the arms are supposed to be eyes. They feed on oysters. Cold fresh water kills them.
IV. Crinoidea	Animals fixed to the sea-bottom, resembling somewhat in form the bud and stem of a water-lily, as *crinoid* or *sea-lily.*
V. Anthozoa	Marine animals, as *sea-anemone, coral polyps*, and corals of various kinds.
VI. Hydrozoa	Animals with soft, gelatinous, semi-transparent bodies, frequently of beautiful colors of claret or pink, as *jelly-fish, medusa, Portuguese-man-of-war, hydra.*

CLASSES—LOWEST ANIMALS.

The branch V. PROTOZOA *is divided into* classes, *as follows:*

I. SPONGIDA . . .	The sponge is a compound animal, composed of an exceedingly soft, filmy substance, covering a net-work of horny fibres, which this substance secretes. Sponges increase by sperm-cells.
II. INFUSORIA . . .	A group of exceedingly minute particles, living in stagnant water. They multiply very rapidly.
III. RHIZOPODA . .	These animals have root-like filaments extending from the main mass of the body. They are exceedingly minute, yet secrete calcareous or siliceous shells. These enter largely into the formation of chalk cliffs, sand, etc.
IV. GREGARINIDA .	These are the lowest and simplest forms of living animal substance. They are exceedingly minute, and are found in the earth-worm and cockroach.

ORDERS OF ANIMALS.

MAMMALS—ORDERS OF.

The class I. MAMMALIA *is divided into orders, as follows:*

I. BIMANA.—**Two-handed**, as *man.*

II. QUADRUMANA.—**Four-handed**, as *monkeys, apes, gorilla, chimpanzee, orang-outang, lemurs, baboon.*

III. CARNIVORA.—**Flesh eaters**, as *cats, lion, leopard, panther, dogs, wolf, fox, hyena, bear, wolverine, weasel, skunk, badger, otter, seal, sea-lion, walrus.*

IV. UNGULATA.—**Hoofed quadrupeds**, as *horse, zebra, cow, sheep, goat, buffalo, antelope, gazelle, deer, moose, caribou, hog, peccary, hippopotamus, rhinoceros, elephant, tapir, camel, llama, giraffe.*

V. CHEIROPTERA.—**Hand-winged**, as *bats.*

VI. INSECTIVORA.—**Insect eaters**, as *moles, hedgehogs, shrews.*

VII. RODENTIA.—**Gnawing animals**, as *rats, mice, squirrels, gophers, beavers, guinea-pigs, porcupines, woodchucks, prairie-dogs.*

VIII. EDENTATA.—**Without enamelled teeth**: some have no kind of teeth, as *ant-eater, sloth, armadillo.*

IX. MARSUPIALS.—**Pouched animals**, as *kangaroo, opossum, wombat.*

X. SIRENIA.—**Fish-like mammal**: feed on herbs; live in great rivers and warm parts of oceans near shores, as *manatee,* or *sea-cow, dugong, stellers.*

XI. CETACEA.—**Whales**: fish-like mammals that live in the ocean; feed on minute animals of the sea, as *whale, dolphin, porpoise, narwhal.*

Fish-like mammals breathe by means of lungs; they are obliged to come up to the surface of the water to take air. *Their broad, flat tails are horizontal to the water;* this position gives them greater power for rising to the surface.

True fishes breathe under water by means of gills. *Their tails are perpendicular to the water*, and are the means by which they propel themselves and direct their course in the water.

BIRDS.*

A bird may be defined as an *air-breathing*, *egg-laying*, *warm-blooded*, *feathered vertebrate;* with two legs for perching, walking, or swimming, and two wings for flying. Birds may be divided into three great groups, in accordance with their modes of life.

Aerial Birds are those which *habitually live above the earth*, in the air, or on trees, embracing those commonly known as birds of prey, perchers, climbers, as *eagle*, *hawk*, *thrush*, *sparrow*, *woodpecker*, *parrot.*

Terrestrial Birds are those which *habitually live on the ground*, and commonly known as waders, scratchers, and runners, as *heron*, *crane*, *hen*, *quail*, *ostrich.*

Aquatic Birds are those which *habitually live on the water*, and are commonly called swimmers, as *duck*, *swan*, *pelican*, *gull*, *loon*, *penguin.*

BIRDS—ORDERS OF.

The class Aves (Birds) *is divided into orders, as follows:*

I. Passeres.—**Perchers**: birds that have feet with four toes adapted to perching, including the *oscines*—singing birds —as *thrush*, *mocking-bird*, *bluebird*, *warbler*, *catbird*, *cross-bill*, *cedar-bird*, *starling*, *oriole*, *blackbird*, *lark*, *bobolink*, *robin*, *chickadee*, *wren*, *jay*, *crow;* also of the *clamatores* —birds that do not sing—as *flycatcher*, *kingbird*, *barn-swallow*, *sand-martin*, *pewee.*

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* The Classification of Birds given here is essentially that of Elliot Coues, Sanborn Tenney, and Agassiz.

II. PICARIÆ.—**A miscellaneous assortment**: a group of birds that differ from all other groups, yet do not possess many resemblances to each other, as *kingfisher*, *whippoorwill*, *night-hawk*, *chimney-swallow*, *humming-bird*, *cuckoo*, *woodpeckers*.

III. PSITTACI.—**Climbers**: birds that have two toes in front and two turned back. These birds commonly use the bill in climbing, as the *parrot*, *macaw*, *cockatoo*, *paroquet*, *trogons*, *toucans*, *barbet*.

IV. RAPTORES.—**Birds of prey**, as *eagles*, *hawks*, *falcons*, *kites*, *buzzards*, *owls*, *vultures*, *condor*, *turkey-buzzard*, *secretary-bird*.

V. COLUMBÆ.—**Pigeons**, as *doves*, *pigeons*, etc.

VI. GALLINÆ.—**Scratchers**, as *hens*, *turkeys*, *grouse*, *quails*, *prairie-chicken*, *peacocks*, *guinea-hen*.

VII. CURSORES, or BREVIPENNES. — **Short-winged, running birds**, as *ostrich*, *emu*, *rhea*, *bustard*, *apteryx*.

VIII. GRALLATORES.—**Waders**: generally have slender bodies, long, bare legs, long necks, pointed bills. This order includes three groups: **Shore birds**, as *plover*, *snipe*, *sandpiper*, *turnstone*, *stilt*, *woodcock*, *curlew*, *avocet*, *yellow-legs*. **Heron Group**, as *great blue-heron*, *bittern*, *night-heron*, *squawk*, *stork*, *ibis*, *spoonbill*. **Crane and Rail Group**, as *whooping-crane, sand-hill-crane*, *Carolina-rail*, *clapper-rail*, *marsh-hen*, *gallinule*.

IX. LAMELLIROSTRES.—**Swimmers, with teeth-like edges to their bills**, as *ducks*, *geese*, *swans*, *widgeon*, *teal*, *mergansers*.

X. STEGANOPODES.—**Swimmers, whose feet have three full webs**, as *pelicans*, *cormorants*, *gannets*, *snake-birds*, *frigate*, or *man-of-war birds*.

XI. LONGIPENNES.—**Swimmers, with very long wings**, as *gulls*, *albatross*, *petrel*, *tern*.

XII. PYGOPODES.—**Swimmers, with legs placed far back on the body**: they are diving birds, as *loon*, *grebe*, *penguin*, *puffin*, *auk*.

REPTILES—ORDERS OF.

The class Reptilia *is divided into orders, as follows:*

I. Chelonia.—**Turtles**: animals whose bodies are protected by horn-like shells, as *box-turtles*, *snapping-turtles*, *mud-turtles*, *terrapin*, *hawk-bill-turtle*, *wood-tortoise*, *sea-turtles*.

II. Crocodilia.—**Large reptiles**, whose bodies are covered with horny scales and bony plates, as *alligators* of America, and *crocodiles* of Africa and Asia.

III. Lacertia.—**Lizards**, as the *green lizard*, *striped lizard*, *iguana*, *gecko*, *chameleon*, *horned toad*.

IV. Ophidia.—**Snakes**: scaly reptiles without feet, as *black-snake*, *striped-snake*, *water-snake*, *rattlesnake*, *copper-head*, *moccasin*, *viper*, *boa-constrictor*.

INSECTS—ORDERS OF.

The class Insecta *is divided into orders, as follows:*

I. Hymenoptera. — **Membrane-winged insects**, with four wings, as *bees*, *wasps*, *gall-flies*, *ichneumon-fly*, *saw-fly*, *ants*.

II. Lepidoptera.—**Scaly-winged insects**, with four wings, as *butterflies*, *moths*.

III. Diptera.—**Two-winged insects**, as *house-fly*, *musquitoes*, *horse-fly*, *wheat-fly*, *bot-fly*, *flesh-fly*, *fleas*, *sheep-ticks*.

IV. Coleoptera.—**Sheath-winged insects**, with upper wings horny, under wings membranous, as *common ground-beetle*, *tiger-beetle*, *carrion-beetle*, *snapping-bugs*, *potato-beetle*, *lady-bugs*, *long-horned-beetles*, *weevils*.

V. Hemiptera.—**Not full-winged**: two hind wings much smaller than front ones, as *bugs*, *harvest-flies*, *seventeen-year-locusts*, *tree-hopper*, *plant-lice*, *cochineal*, *chinch-bug*, *squash-bug*, *bed-bug*, *aphis*.

VI. Orthoptera.—**Straight-winged insects**: front or outer wings thick, as *grasshopper*, *migratory locust*, *cricket*,

katydid, *white-climbing-cricket*, *mantis*, *walking-stick* and *walking-leaf*, *cockroach*, *earwig*.

VII. NEUROPTERA.—**Nerve-winged insects**, with four net-veined wings, as *dragon-flies*, *May-flies*, *stone-flies*, *ant-lion*, *caddis-fly*, *spring-tails*.

MAMMALS—FAMILIES OF.

FAMILIES OF FLESH-EATERS.

The order III. CARNIVORA *is divided into families, as follows:*

I. FELIDÆ.—**Cat Family**: round head; short ears; can see as well by night as by day; teeth adapted to tearing flesh; rough tongue; sensitive whiskers; strong, sharp, retractile nails; five toes on each forefoot; feet with soft pads; skin loose; covered with soft, fine hair, as *cats*, *lynx*, *panther*, *lion*, *tiger*, *leopard*, *jaguar*, *ocelot*.

II. MUSTELIDÆ.—**Weasel Family**: long, slender body; short legs; sharp claws; head oval; teeth long and sharp; tongue smooth; covered with thick, soft fur, as *weasel*, *marten*, *ferret*, *mink*, *ermine*, *polecat*, *otter*, *badger*, *wolverine*, *skunk*.

III. CANIDÆ.—**Dog Family**: long, pointed head; long ears; sharp teeth; smooth tongue, as *dog*, *wolf*, *fox*, *jackal*.

IV. HYENIDÆ.—**Hyena Family**: fore legs longer than hind ones; four toes on each foot; strong jaws; nocturnal in habits; they are scavengers, living on animals which they find dead; inhabit Africa and Asia.

V. URSIDÆ.—**Bear Family**: are five-toed; walk on the whole sole of the foot; eat both animal and vegetable food, as *bears*, *raccoons*.

VI. VIVERRIDÆ.—**Civet Family**: have some resemblance to cats, also to raccoons, as *civet-cats*, *genet*.

VII. PHOCIDÆ.—**Seal Family**, as common *seals*.

VIII. OTARIIDÆ.—**Eared-seal Family**, as the *fur-seal*, or *sea-bear*, and *sea-lion*.

IX. ROSMARIDÆ.—**Walrus Family**, as the *walrus*.

FAMILIES OF HOOFED ANIMALS.

The order IV. UNGULATA *is divided into two groups*—**Ruminants—cud-chewers**; *and* **Non-ruminants—hoofed animals that do not chew their food twice.** *The ruminants are divided into three smaller groups*—**hollow-horned, solid-horned, hornless.** *The hoofed quadrupeds are divided into families, as follows:*

FAMILIES OF RUMINANTS.

I. BOVIDÆ.—**Ox, Sheep, and Antelope Family**: have cloven hoofs; heads long; no front teeth on upper jaw; hollow horns, with a bony pith or core, and do not shed their horns; generally timid; get up on their hind feet first; chew their food second time, while at rest; are of great service to man, as *cow*, *bison*, *buffalo*, *sheep*, *goat*, *antelope*, *gazelle*, *horned-horse*, or *gnu*.

II. CERVIDÆ.—**Deer Family**: have cloven hoofs; long heads; no *front* teeth on upper jaw; solid, branching horns, which are shed each year; very timid; get up on hind feet first; chew their food second time, when at rest, as *deer*, *moose*, *caribou*, *reindeer*, *elk; musk-deer* of Asia has no horns.

III. GIRAFFIDÆ.—**Giraffe Family**: the tallest quadruped; fore legs longer than hind ones; body short; neck very long; no front teeth on upper jaw; short, solid horns; do not shed them; chew the cud; has a prehensile tongue; feeds on leaves of trees; native of Africa; the *giraffe* is the only animal of this family.

IV. CAMELIDÆ.—**Camel Family**: have broad, pad-like feet, with two hoof-covered toes; *have front teeth on upper jaw;* chew the cud; have no horns; native of Central and South-western Asia and South America, as *Bactrian camel*, *Arabian camel*, *llama*, *guanaco*, *vicuna*.

Non-Ruminants.

V. Equidæ.—**Horse Family**: have solid hoofs; do not chew food twice; get up on their forefeet first, as the *horse*, *zebra*, *ass*.

The five following families form a group of thick-skinned animals; hence are sometimes called **pachyderms**. They eat vegetable food; do not chew the cud; the skin is nearly naked, or covered with bristles; wallow in mud; most of them have tusks.

VI. Elephantidæ.—**Elephant Family**, as *elephants*.

VII. Suidæ.—**Swine Family**, as *hogs*, *peccaries*.

VIII. Hippopotamidæ.—**Hippopotamus Family**, as *hippopotamus*.

IX. Rhinocerotidæ.—**Rhinoceros Family**, as *rhinoceros*.

X. Tapiridæ.—**Tapir Family**, as *tapirs*.

FAMILIES OF GNAWERS.

The order VII. Rodentia *is divided into families, as follows:*

I. Muridæ.—**Rat Family**, as *rats*, *mice*, *white-footed field-mouse*, *short-tailed field-mouse* or *meadow-mouse*, *jumping-mouse*, *common mouse*, *harvest-mouse*, *brown rat*, *muskrat*, *hamster*, *leming*.

II. Saccomyidæ.—**Pouched-gopher Family**: have cheek pouches, as *pouched-gopher*, *kangaroo-rats*.

III. Sciuridæ.—**Squirrel Family**: generally have bushy tails, as *squirrels*, *chipmunk*, *gray-gopher*, *striped-gopher*, *woodchuck*, *marmot*, *prairie-dog*.

IV. Castoridæ.—**Beaver Family**, as *beavers*.

V. Hystricidæ.—**Porcupine Family**: animals covered with quill-like spines, as *porcupines*.

VI. Dasyproctidæ.—**Agouti Family**, as *agouties* and *pacas* of South America.

VII. Cavidæ.—**Guinea-pig Family**, which is not a pig at all, but a gnawing animal from South America.

VIII. HYDROCHŒRIDÆ.—**Capybara Family**, as the *capybara* or *water-hog* of South America.

IX. CHINCHILLIDÆ.—**Chinchilla Family**, as the *chinchilla* of South America, valued for its soft fur; *jereboa.*

X. LEPORIDÆ.—**Hare Family**, as *hares*, *rabbits*, etc.

Families of Gnawers.—The order Rodentia may be known by their front teeth, which are four in number—two on each jaw. They are curved, and have chisel-shaped ends. The front is covered with a layer of very hard enamel, while the back is composed of a softer material. The result is, the softer parts wear away, by gnawing, faster than the thin fronts; thus the teeth have sharp, cutting edges all the time. The teeth grow at the base as fast as they wear off, so that they keep even at the ends. These teeth are fitted for cutting very hard materials. The food of these animals consists of grains, nuts, bark, fruit, roots, etc. They are all timid, and trust to concealment or flight for safety. More than one-half of all the *mammals* in the world belong to the *Order of Rodents.*

BIRDS—FAMILIES OF.

BIRDS OF PREY.

The order RAPTORES *is divided into three groups*—**Diurnal Birds of Prey**, *as eagles*, *hawks;* **Nocturnal Birds of Prey**, *as owls;* **Vultures**. *This order is also divided into families, the members of which are noted for short, strong beaks, which end in a sharp-pointed hook, and for their stout legs, large, curved, and sharp claws.*

I. FALCONIDÆ.—**Falcon Family**: have the head and neck fully covered with feathers; eyebrows projecting; eyes sunken and piercing; sight keen and very extended; flight soaring; live in pairs; feed on flesh of animals which

they capture; found in all parts of the world, as *eagles*, *falcons*, *hawks*, *buzzards*, *kites*, *harriers*, *fish-hawks*.

II. STRIGIDÆ.—**Owl Family**: have large, round heads; short, hooked beaks, which are nearly hidden by feathers; large eyes, with widely opening pupils; can see best during twilight, at which time they seek their food, of mice, reptiles, and small birds; hearing very acute; fly without making a noise; legs and feet covered with feathers; outer toe can be directed forward or backward, as *barn-owl*, *great horned-owl*, *screech-owl*, *snowy-owl*, *burrowing-owl*.

III. VULTURIDÆ.—**Vulture Family**: have head and neck without feathers, usually naked, or sparsely covered with down; eyes not sunken; sight good; sense of smell very strong; feed on bodies of animals found dead; live in warm countries; they are scavengers among birds, as hyenas are among quadrupeds. The *Old World vultures* are the *Arabian vulture*, *Angola vulture*, *bearded vulture*. The last has feathers on its head, and captures its own prey; it is more like an eagle.

IV. CATHARTIDÆ.—**American Vultures**, as the *condor of the Andes*, *California vulture*, *turkey-buzzard*, *carrion-crow*.

V. GYPOGERANIDÆ.—**The Secretary-bird**, or *serpent-eater* of South Africa.

FAMILIES OF SCRATCHERS.

The order **Gallinæ**, commonly known as **scratchers**, comprises five families. The members have heavy body; small head; short wings, not adapted to long flight; toes nearly straight, with short, blunt nails, suitable for scratching; three front toes longest; beaks short and stout; build nests on the ground; usually select some elevated position for a roosting-place at night; young are hatched with their eyes open, and are able to run about soon after leaving their shell; food consists chiefly of grain, seeds,

and insects; lay many eggs. This order is divided into families, as follows:

I. PHASIANIDÆ.—**Pheasant Family**, as *pheasants*, *hens*, *peacock*, *guinea-fowl*.

II. MELEAGRIDÆ.—**Turkey Family**, as *turkeys*.

III. TETRAONIDÆ.—**Grouse Family**, as *ruffed-grouse* or *partridge*, *prairie-hen*, *quail*, *ptarmigan*.

IV. CRACIDÆ.—**Curassow Family**, as *curassow*, *guan*.

V. COLUMBIDÆ.—**Pigeon Family**, as *wild pigeon*, *carrier-pigeon*, *dove*.

FAMILIES OF PERCHERS.

The following families embrace the principal groups of perching birds, into which the order PASSERES *is divided:*

I. TURDIDÆ.—**Thrushes**, as *wood-thrush*, *brown-thrush*, *mocking-bird*, *catbird*, *robin*.

II. SAXICOLIDÆ.— ———, as *stone-chats*, *bluebirds*.

III. CINCLIDÆ.—**Dippers**, as *dipper*, *water-ouzel*.

IV. SYLVIIDÆ.— ———, as *kinglet*, *gnatcatchers*.

V. PARIDÆ.—**Chickadees**, as *chickadee*, *titmouse*.

VI. SITTIDÆ.—**Nuthatches**, as *nuthatches*.

VII. CERTHIIDÆ.—**Creepers**, as *brown-creeper*.

VIII. TROGLODYTIDÆ.—**Wrens**, as *house-wren*, *Carolina wren*.

IX. ALAUDIDÆ.—**Larks**, as *skylark* and *starling* of Europe, *horned-lark* of United States.

X. MONTACILLIDÆ.—**Wagtails**, as *yellow wagtail*, *titlark*, *brown lark*, *Missouri skylark*, *pipit*.

XI. SYLVICOLIDÆ.—**American Warblers**, as *worm-eating warbler*, *blue-winged yellow warbler*, *black-throated green warbler*, *yellow-breasted chat*, *hemlock warbler*, *water-thrush*, *Canadian flycatcher*, *redstart*.

XII. TANAGRIDÆ.—**Tanagers**, as *scarlet tanager*, *summer red-bird*.

XIII. Hirundinidæ.—**Swallows**, as *barn-swallow*, *cliff* or *eave swallow*, *bank-swallow* or *sand-martin*.

XIV. Ampelidæ.—**Waxwings**, as *Carolina waxwing*, *cedar-bird;* feed on berries and soft fruit.

XV. Vireonidæ.—**Vireos**, as *red-eyed vireo*, *warbling vireo*.

XVI. Laniidæ.—**Shrikes**, as *butcher-bird*.

XVII. Fringillidæ.—**Finches**, as *grosbeak*, *bullfinch*, *crossbill*, *yellow-bird*, *snow-bunting*, *snow-bird*, *song-sparrow*, *chip-bird* or *chipping-sparrow*, *field-sparrow*, *English sparrow*, *rose-breasted grosbeak*, *indigo-bird*, *cardinal red-bird*, *canary-bird*.

XVIII. Icteridæ.—**American Starlings**, as *bobolink*, or *reed-bird*, or *rice-bird* (the same bird has these different names), *cow-bird*, *yellow-headed blackbird*, *red-winged blackbird*, *field-lark*, *Baltimore oriole* or *hang-nest*, *purple grackle*.

XIX. Corvidæ.—**Crows, jays, etc.**, as *raven*, *crow*, *magpie*, *blue-jay*.

XX. Tyrannidæ.—**Flycatchers**, as *kingbird*, *crested-flycatcher*, *pewee* or *phœbe*, *wood-pewee*, *green-crested flycatcher*, *least flycatcher*.

PLANTS.

Plants are living things; they feed, grow, and perform various kinds of work. Their forms, colors, uses, habits, and other characteristics place them among objects especially adapted to the cultivation of careful observation. Indeed, the study of plants may be called the science of observation.

Each part of the plant performs its own peculiar part of the work. *The root* holds it to the ground, and absorbs nourishment from the soil. *The leaves* absorb light and air, and aid in changing the fluids and nourishment that are taken up by the roots into materials for building up the plant. *The buds* hold and protect the blossoms until the time of their flowering. *The blossom* produces the fruit. *The bark* of exogens protects the tender new wood which is formed each year outside of the old wood.

How Plants Take Food.—*The food* of plants is always liquid and gaseous, never solid. The roots absorb water, in which mineral matters, such as nitrogen, phosphorus, sulphur, potash, and iron are dissolved; and this fluid ascends through the stem, and branches to the cells of the leaves. The leaves absorb carbonic acid gas from the air, which also enters the leaf cells, where the sunlight causes chemical changes to take place, by which the carbon is separated and retained by the plant, and oxygen given back to the air. The carbon unites with the fluid in the cells, and forms starch in a liquid state. This sap is conveyed to all parts of the plant where growth takes

place, and supplies the materials for the nourishment and growth of the plant, somewhat as the blood in animals supplies the nourishment for their growth. Thus we see that plants must have water, air, and sunlight to enable them to take food and grow. [See pages 130, 131.]

How Seeds Grow.—Place seeds of plants, as peas, beans, corn, wheat, oats, mustard, etc., in the earth, where they will have warmth, moisture, and air, and each will develop a root to absorb nourishment from the ground, and a stem to reach above the ground for light and air. The stem becomes the support of leaves, buds, and flowers.

Buds form on trees in autumn, and remain dormant till spring; they are covered with scales that protect them from wet and cold. The warmth of the sun in spring, together with air and moisture, causes the buds to expand into leaves and blossoms, the sap or juice to flow from the roots through the trunk, limbs, and leaves, and the process of growth to take place throughout the tree or plant.

Annual Plants are those which grow from seed, blossom, and die each year, as *corn*, *wheat*, *oats*, *mustard*, *beans*, *morning-glory*, etc.

Biennial Plants.—Some plants grow during the first year after the seed is planted, live through the winter, blossom and produce seed the second year, then die. These are called *biennials.* To this class belong the *turnip*, *carrot*, *beet*, *parsnip*, *radish*, etc.

Perennial Plants.—Some plants live on year after year, as *trees*, *shrubs*, and other plants with woody stems, as *rose-bush*, *grape-vine*, *ivy ;* also plants with soft stems that die to their roots each year, among which are those called *herbs*, as *sweet-flag*, *iris*, *lily*, *peppermint*, and *grasses ;* also the *dahlia*, *peony*, *pink*, and other flowering

plants. *Shrubs* seldom grow to a height twice that of a man.

Habits of Plants.—Plants not only grow, blossom, and produce fruit, but many of them have very interesting habits, among which are those of *climbing* by *creeping* and by *twining*, *sleeping* and *awaking*, *catching insects*, etc.

The English ivy, the poison ivy, and the trumpet-creeper climb by creeping. They creep up the face of walls and the trunks of trees by fastening little flat rootlets, which the plant sends out along the stem against the supporting objects.

The hop, some kinds of beans, morning-glory, honeysuckles, and other plants climb by twining spirally around some supporting object. But these do not all twine in the same direction. The *hop* and some *honeysuckles* twine around with the sun—from right toward the left. The *bean*, *morning-glory*, and nearly all the other twining plants turn around against the sun—from left toward the right.

The pea, grape-vine, Virginia creeper, and passion-flower climb by *tendrils*. The clematis climbs by the footstalk of the leaf, which coils like a tendril.

Sleeping and Waking.—Some plants have regular habits as to the time of closing and opening their blossoms and leaves. The locust and wood-sorrel turn down their leaflets at night, and turn them up again in the morning. The honey-locust raises its leaves upright at night, and turns them down again in the morning.

The morning-glory opens its blossoms about two o'clock in the morning, and closes them about ten o'clock in the forenoon. The vegetable oyster opens at four o'clock in the morning, and closes about noon. The four-o'clock opens about four o'clock P.M. The evening primrose

opens about six o'clock P.M. The Cereus grandiflora blooms about eight o'clock in the evening, and the flower lasts but a few hours.

Plants have Family Relatives.—Some plants have a great many family relatives. The *Rose Family* is very large, and also a very important one. All of our delicious berries and fruits belong to this useful family. The onion, the garlic, and asparagus are family relatives of the lily-of-the-valley. The *Pink Family* is a large one, but is chiefly noted for its pretty flowers. It does not supply us with food or medicine.

Hints for Manner of Giving Lessons on Plants.—Such facts as the foregoing, and many similar ones, may be so presented to children as to gratify their desire to know about these things which they see daily; and lessons on plants may be conducted in a manner to awaken in the pupils a deep interest for the study of plants, while they are acquiring excellent habits of careful observation that will be valuable to them in any position in life.

Care should be taken that the first lessons do not become too formal and technical by attempting to follow the lessons in the text-book on botany; also that they be sufficiently general in their character to permit that proper range of observation which children can make under a guidance which allows the greatest freedom consistent with the accumulation of facts for association and subsequent classification. As the interest and knowledge of the pupils increase, and the facts learned become somewhat numerous, more and more system may be introduced into the lessons. In the beginning of the lessons seek rather to follow Nature than to lead her. Let the children see whole things first, and afterward lead them to notice parts of them and single facts. Gradually lead the pupils to notice as many facts as possible that are pe-

culiar to any particular plant. Tell them some facts, not easily discovered, to arouse their curiosity, but request them to look for themselves and verify that which you tell them, that it may be more vividly and firmly fixed in their minds. Point out, also, the way by which pupils can discover new facts for themselves. *Let the teacher's constant aim be, during all these lessons, to lead the pupils to stand face to face with nature, and learn to use their own senses in gaining knowledge.*

Leaves.—For some lessons let children collect leaves and compare their shapes, and learn names for their shapes.

Roots.—For some lessons let the pupils notice the different shapes of roots, and learn their names.

Shapes of Flowers.—For other lessons let them notice those flowers that resemble common objects, as *bell-shaped*, *funnel-shaped*, *butterfly-shaped*, etc.

Family of Plants.—Teaching children to distinguish those traits of resemblance by which plants are grouped into families will supply many interesting lessons. Here good text-books on botany may be used to aid both teacher and pupils.

During those lessons on plants in which the chief purpose is to awaken a desire to know more about nature, and to form habits of investigation as a means of developing the mental powers of your pupils, and of leading them to accumulate practical knowledge by their own experiences, remember that you must not make these lessons a formal study of botany.

FACTS FOR TEACHERS.

ABOUT PLANTS.

TEACHERS need to have within easy access a variety of facts about each subject of instruction as a means of ready reference, and as an aid in the preparation of lessons for their pupils. With the view of meeting this need, in part, on the subject of *Plants*, the following statements and descriptions are given. These are not to be used as lessons for the pupils to learn, but to suggest to teachers some of the important facts relating to plants which they may lead their pupils to observe.

Lessons for systematic instruction upon any subject ought to commence with objects, belonging to that subject, which are already familiar to children by common notice; therefore leaves, flowers, and roots are among suitable subjects for early lessons upon plants.

Furthermore, it should be borne in mind by the teacher that the habits of careful observation, comparison, and classification which the pupils acquire by proper attention to this subject is of at least as much value to them as all the facts which they may learn concerning the subject. Hence, in conducting the lessons on plants, the teacher should give more attention to the formation of proper habits of learning than to the mere acquisition of facts by memory.

SHAPES OF LEAVES.

NEEDLE-SHAPED.—[*Acerose.*] Long, slender leaves, of equal size throughout, usually growing in clusters, as the leaves of the *Pine.* The *White Pine* has *five* leaves in a cluster, each from three to four inches long. The *Pitch Pine* has *three* leaves in a cluster, each from four to five inches long. The *Red Pine* has *two* leaves in a cluster, each from five to six inches long. Some other varieties of Pine have the same number of leaves in a cluster as each of the above, but their leaves differ in size and length.

SWORD-SHAPED.—[*Ensiform. Linear.*] *Linear* leaves are very narrow, and several times longer than their width, with parallel edges or margins, as the leaves of *Grass*. *Ensiform* leaves are also *linear*, but the form of the leaves resembles the English sword, or the cut-and-thrust sword, while the *grass leaf* resembles the *rapier*, a straight sword. The *Iris*, or *Flag-leaf*, is *ensiform*.

LANCE-SHAPED.—[*Lanceolate.*] Leaf several times longer than its width, narrow, and gradually tapering to a slender point, as the *Peach* leaf and the *Willow* leaf.

ARROW-SHAPED.—[*Sagittate.*] Long, narrow, and tapering to a point, with pointed lobes at the base, extending backward like an arrow-head, as the leaf of the *Calla*, *Scratch-grass*, and *Arrow-head*.

SPEAR-SHAPED.—[*Hastate.*] Leaves generally broader than the arrow-shaped, tapering more abruptly to a point, and having the pointed lobes at the base extending outward, as the leaves of common *Sorrel*, *Bind-weed*, *Sage*.

SHIELD-SHAPED.—[*Peltate.*] A circular leaf, with the stem attached near the centre of the lower surface, as in the *Nasturtium*, *Mandrake*, *White Water-lily*.

EAR-SHAPED.—[*Auriculate.*] This name pertains only to the *base* of the leaf, and is applied to those leaves having small, rounded lobes, or ear-like projections on each side of the stem, like the lobes of the ears, as the base of the leaf of the *Ear-leaf Magnolia*.

EGG-SHAPED.—[*Ovate.*] An ovate leaf has a broad, curved base and a narrower curved apex, with the entire form like that of a common egg, as a *Rose* leaf.

HEART-SHAPED.—[*Cordate.*] When an egg-shaped leaf has a notch at the base, or when the leaf has the shape in which a heart is usually represented, it is called *heart-shaped*, as the leaf of the *Morning-glory* and the *Lilac*.

KIDNEY-SHAPED.—[*Reniform.*] A kidney-shaped leaf is broader than it is long; it is a short, rounded leaf, having a base somewhat like the heart-shaped leaf, but with the base lobes more distant from the stem than in the latter, as the *Wild Ginger* leaf.

HAND-SHAPED.—[*Palmate.*] A leaf that is divided into five lobes, or parts, without these parts being separated to the base or stem, as the *Sweet-gum* leaf and some *Maple* leaves.

Leaves that are divided into separate parts, or fingers, are called *Digitate* or *Fingered* leaves, as the *Virginia Creeper*, the *Buckeye*.

WEDGE-SHAPED.—[*Cuneate.*] A leaf that is broad at the top, and tapers with nearly straight edges to the stem, like a wedge, as the leaf of the *Cockspur-thorn.*

OBLONG LEAF.—A leaf that is at least two and a half or three times as long as it is broad, and of nearly the same breadth throughout its length; it is narrowly elliptical in shape, as the *Rose-bay*, *Primrose.*

OVAL LEAF.—A leaf that is broadly elliptical in form; usually the ends are more sharply rounded than in the *oblong* leaf, with the breadth not quite half as great as the length. When the breadth is twice the length, or a little more, with the outline of an ellipse, the shape is called *elliptical.* The *oval* leaf is represented in the *Beaver-tree*, or *small Magnolia.*

ORBICULAR LEAF.—[*Circular*, *Rotund.*] A leaf that has a resemblance to a circular shape, with the stem attached nearer the base than in the *peltate* leaf, as *Round-leaved Sundew*, *Marsh-marigold.*

FEATHER-SHAPED.—[*Pinnate.*] A compound leaf in which the leaflets are arranged on the sides of a main leaf-stalk, as the *Locust*, *Ash.* Sometimes the leaflets are themselves divided and arranged on the sides of branches of the main leaf-stalk, as in the *Honey-locust.* Such leaves are said to be *feathered*, or *doubly-pinnate*, or *twice-pinnate*, or *bi-pinnate.*

ROUND-LOBED, SHARP-LOBED.—[*Lobate.*] When the sides of a leaf are cut into an equal number of parts, with the incisions extending from one-fourth to one-half of the distance from the edge to the mid-vein, it is said to be lobed. If these parts or *lobes* are rounded, the leaf is said to be *round-lobed*, as in the *White Oak.* If the lobes are sharp or pointed, the leaf is said to be *sharp-lobed*, as in the *Red Oak.*

PERFORATED LEAF.—[*Perfoliate.*] When the stem grows through the leaf near one end, it is called a perfoliate leaf, or perforated leaf, as the *Bellwort* and the *Honeysuckle.*

LYRE-SHAPED.—[*Lyrate.*] A leaf with the lower part lobed and the upper part somewhat circular, or broad and rounded, as the *Radish* leaf, *Turnip* leaf.

DEEPLY-CUT, *or* GASHED LEAF.—[*Laciniate.*] A leaf that appears as if torn, or cut in deep and irregular gashes, having the parts long and narrow, as *Monk's-head.*

FOOT-SHAPED.—[*Pedate.*] A leaf with several deep clefts separating it into long, narrow parts, resembling the toes of a bird's foot, as the *Passion-flower*, *Christmas-rose.*

WHORLED LEAVES.—[*Verticillate.*] Three or more leaves growing around the stem of a plant, in a circle, as in the *Red-lily*, *Trumpet-weed.*

BUNDLED, *or* CLUSTERED LEAVES.—[*Fascicled.*] A bunch of many short, needle-shaped leaves growing in a cluster, on a short, bud-like branch, as the leaves of the *Larch*, *Tamarack.*

SHAPES OF FLOWERS.

FUNNEL-SHAPED.—[*Infundibuliform.*] A tubular flower which gradually enlarges from its base, and rapidly spreads out at the upper part into a wide, circular border. So called from its resemblance to a common funnel. Examples: *Morning-glory*, *Stramonium*, *Tobacco.*

TRUMPET-SHAPED, *or* TUBULAR.—A flower having a long, narrow tube, widening at the end, and resembling a trumpet, or horn. Examples: *Trumpet-honeysuckle*, *Fuchsias.*

BELL-SHAPED.—[*Campanulate.*] A flower having a shape like a common bell. Examples: *Harebell*, *Bell-flower*, *Canterbury-bell.*

SALVER-SHAPED.—[*Hypocrateriform.*] A tubular flower, the upper end of which spreads out abruptly into a flat border, like an ancient tray, or salver. Examples: *Phlox*, *Heliotrope*, *Lilac.*

LIP-SHAPED.—[*Labiate.*] A flower with a tubular base, having the upper part open so as to resemble lips, or a mouth. Examples: *Sage*, *Hyssop*, *Skull-cap.*

CROSS-SHAPED.—[*Cruciform.*] A flower with four spreading petals standing at right angles, so as to resemble a Maltese cross. Examples: *Mustard*, *Wallflower*, *Water-cress.*

WHEEL-SHAPED.—[*Rotate.*] Sometimes called *Star-shaped.* A flower without a tube, or with a very short one, which seems to spread out into five distinct divisions, somewhat like a wheel with five spokes. Examples: *Potato-blossom*, *Tomato*, *Mullein*, *Bitter-sweet.*

BUTTERFLY-SHAPED.—[*Papilionaceous.*] A flower consisting of five dissimilar petals, so arranged as to resemble a butterfly. The large petal at the top is called the "banner;" the two side petals are called "wings;" and the two central, lower petals, which appear to be joined, are called the "keel," from the resemblance to the prow of an ancient boat. Examples: *Sweet-pea*, *Locust*, *Wistaria*, *Bean*, *Clover.*

HELMET-SHAPED.—[*Galeated.*] A flower having its upper part in the form of a hood, or helmet. Example: *Monk's-hood.*

STRAP-SHAPED.—[*Ligulate.*] This form is seen in plants with compound flowers, as *China-aster*, *Daisy*, *Coreopsis*, *Sunflower*, etc. Each *strap-shaped flower*, which appears so much like a single flat petal of an ordinary flower, is a *distinct flower.* Its edges are rolled together at the base, so as to form a short, tubular portion. Great numbers of these single flowers grow together, forming what is commonly called compound flowers.

PINK-SHAPED.—[*Caryophillaceous.*] A flower with five broad petals, each with a long claw extending down into a tubular cup, or calyx. Examples: *Pink*, *Bouncing-bet.*

LILY-SHAPED.—[*Liliaceous.*] A flower, somewhat bell-shaped, with six petals of uniform size and color, and six stamens. The petals turn back at the mouth of the flower, so as to separate widely at their outer ends. Examples: *Tiger-lily*, *White-lily*, *Japan-lily.*

SHAPES OF ROOTS.

CONICAL ROOT.—A solid root which tapers regularly from the upper end to its lower extremity, as the *Carrot*, *Parsnip*, and some *Beets.*

SPINDLE-SHAPED ROOT.—[*Fusiform.*] A solid root which increases in size from the top toward the centre, and tapers regularly from the centre to the lower extremity. It tapers from near the middle toward each end, as the *Radish*, *Ginseng*, and some *Beets.*

TURNIP-SHAPED.—[*Napiform.*] A short, solid root which abruptly swells out at its upper part, and abruptly diminishes in size, so that the diameter of its body is equal to or greater than its length; and it has a small tapering root extending from its bottom, as the common *Turnip* and some *Radishes.*

TUBEROUS ROOTS.—Several fleshy roots growing in a bunch, each usually having a few fibres, as the roots of the *Dahlia*, *Orchis*, *Peony*, *Sweet-potato.*

TUBERS.—In some plants the ends of the root-like branches of the stems which grow underground become greatly enlarged and thickened into fleshy knobs, each of which contains several buds, or eyes; these knobs are called tubers, as in the common *Potato* and *Artichoke.*

Bulb.—A fleshy bud growing in the ground, usually of the shape of a flattened spheroid, having fibrous roots attached at the bottom. Bulbs are usually formed of thick, fleshy scales, or layers, as the *Onion*, *Lily*.

Corm.—A *solid bulb*, or fleshy stem, growing underground, having a shape somewhat like a flattened spheroid, as the solid bulbs, or corms, of the *Crocus*, *Gladiolus*, *Indian-turnip*.

Branching Roots.—Woody roots with numerous branches, resembling the branches of a tree, as the roots of *trees*, and also of *shrubs*.

Fibrous Roots.—A cluster of slender, thread-like roots, nearly uniform in size, growing directly from the base of the plant stem, as *Grass Roots*, *Grain Roots*, and the roots of many of the annual plants.

Bundled Roots.—[*Fascicled.*] Roots that grow in a cluster, somewhat like fibrous roots, but which are much larger and more fleshy, as *Crowfoot*, *Buttercup*.

Runner, *or* Creeper.—A prostrate stem that creeps along the surface of the ground, and sends roots downward at each joint, and puts forth stems and leaves above them, thus forming new plants, as the *Strawberry-plant*.

Root Stock.—[*Rhizoma.*] A fleshy, horizontal stem, or branch, growing underground, with joints and branches, as *Sweet-flag*, *Ginger*, *Solomon's-seal*, *Blood-root*.

Note.—For further information relative to names that may be applied to modified forms of the shapes of *leaves*, *flowers*, and *roots* described in the preceding pages, see a good text-book on Botany. For colored illustrations of these, see *Prang's Natural History Series*, representing the three groups here described.

FAMILIES OF PLANTS.

THE examination and comparison of plants belonging to the same family, and possessing many similar characteristics, furnish excellent means for training children to acquire habits of careful observation and discrimination, and the ability to distinguish those peculiarities which indicate relationship in the vegetable world. To accomplish this important attainment the pupils must themselves handle, examine, and compare the plants and flowers until they become familiar with the leading characteristics of the family. Suitable pictures will aid the pupils in this work, but the plants and their flowers must become familiar by actual examination before a real knowledge of them can be gained.

The following descriptions are given here to assist the teacher in directing the attention of pupils to those characteristics of plants by which family relations may be determined. To give a complete list of the members of the following families has not been attempted here. Such members of each family have been selected as best represent leading traits of the family. For a description of other members of these and of different families, the reader is referred to good text-books on botany.

The teacher will please bear in mind that these descriptions are not to be taught the pupils as lessons to be recited, yet they may be used to assist in discovering the family traits.

The Lily Family.—[*Liliaceæ.*] It is generally known by its regular, symmetrical, and richly colored flowers, with *six petals*, similarly colored, and *six stamens* and *one pistil.* The flower is never enclosed in a sheath, except in the onion group. The stamens are usually inserted in or near the base of the petals.

The seed-vessel, or ovary, is three-celled, with the seeds packed one upon another. The roots of lilies, which are usually bulbous (sometimes tuberous, or fibrous), live from year to year. The leaves are parallel-veined, and generally narrow.

The members of this family are chiefly natives of temperate climates. Some of them are used for food, as the *onion*, *garlic*, and *asparagus*, and others for medicine. A medicinal substance obtained from the bulb of a lily found in the south of Europe is known as *squills*. There are 1200 species of lilies.

Superb Lily, *or* Turk's Cap.—[*Lilium superbum.*] Grows in the Middle and Western States, in prairies and meadows, also cultivated in gardens. Flowers of a bright orange color, with purple spots.

White Lily.—[*Lilium candidum.*] Native of Persia; cultivated here in gardens. Has a thick stem, four feet high, supporting a cluster of large, snow-white, bell-shaped flowers.

Yellow Lily.—[*Lilium Canadense.*] Native of Canada and United States. Stem from two to four feet high, often containing seven or more nodding flowers of a yellow or orange color, spotted with purple inside.

Tiger Lily.—[*Lilium tigrinum.*] Native of China; cultivated in gardens. Stem four or five feet high, containing several orange-red flowers, thickly spotted with black.

Japan Lily.—[*Lilium Japonicum.*] From Japan; cultivated here. Stem two feet high, usually bearing a single, large, white, nodding flower. The petals are compressed into a narrow tube at the base, but widely separated at the outer ends.

Philadelphia Lily.—[*Lilium Philadelphicum.*] Common in the Northern States. Flowers bell-shaped; petals narrow, and separated down to the base, of reddish orange color, and spotted inside with dark purple.

Tulip.—[*Tulipa Gesneriana.*] Native of Persia; cultivated here. Stem about one foot high; flower erect, and bell-shaped, with short stamens. Colors variegated. There are several hundred varieties.

Crown Imperial.—[*Fritillaria imperialis.*] Native of Persia; cultivated. Stem thick, about three feet high, bearing at the top a cluster of large red, or yellow, nodding flowers, beneath a crown of narrow, green leaves.

Lily-of-the-valley.—[*Convallaria majalis.*] Native of Europe; also of mountains from Virginia to Georgia. Usually has two leaves enclosing a stem about six inches long, from the upper side of which hang little white bells, six parted on the edge. These flowers are very fragrant.

HYACINTH.—[*Hyacinthus orientalis.*] Native of Asia Minor; common, as early house plants. Flower stems are twice as long as the leaves, and bear a dense cluster of small flowers, fragrant, and of various colors.

STAR OF BETHLEHEM.—[*Ornithogalum umbellatum.*] From Europe; also growing wild in the United States. Leaves grass-shaped; flower-stalk about one foot high, and branching. Flowers in a group, white within, and marked with a stripe of green on the outside of the petals.

Water-lily Family. WATER-LILY.—[*Nymphæa odorata.*] It will be readily observed that this flower has not the form of a true lily. Indeed, it does not even belong to the family, but to the Water-lily Family, or *Nymphæaceæ.* It is a water-plant, growing in lakes and ponds, with the leaves and flowers floating on the surface of the water.

The flowers of the water-lily are commonly white, sometimes pinkish, or yellowish. The petals are numerous, and grow in regular rows. The stems, which are very long, grow from a root-stock instead of a bulb. This and the following species were placed in this group to show the pupils that the common pond-lily, though called a "lily," differs widely from the true lilies; and to impress upon them the fact that it belongs to a widely different family.

VICTORIA REGIA.—This great water-lily of South America belongs to the same family as our pond-lily. Its leaves grow from four to six feet in diameter. The flowers are sometimes one foot in diameter.

The *Nile Lotus* also belongs to the same family.*

The Pink Family.—The pink plant has narrow, bluish-green leaves, attached to the stem opposite to each other. The stem is slender and branching, and has swollen joints. The flower-cup, or calyx, is cylindrical, and divided into five parts at the top, and has two or more pairs of opposite bracts, or short, pointed leaves at the base. The flower has five broad petals with notched edges. Each petal has a long, slender claw extending down into the calyx.

The pink has usually ten stamens and two pistils, which are curved outward.

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* For a complete list of the members of the Lily Family, and of other families, also for descriptions of them, see *Gray's School and Field Book of Botany*, or *Wood's Class-book of Botany.*

The seed-vessel is one-celled, containing many seeds.

The *Pink Family* [*Caryophyllaceæ*] has many beautiful members, but none of them are useful either as food or medicine.

China Pink.—[*Dianthus Chinensis.*] The flower has large petals, toothed, and of various colors. Native of China; common here in gardens.

Sweet-william, *or* Bunch Pink.—[*Dianthus barbatus.*] The flowers grow in a flat-topped cluster. They are red, or whitish, and sometimes variegated.

Carnation, *or* Clove-pink.—[*Dianthus caryophyllus.*] This species is supposed to be the parent of all the beautiful varieties of carnation pinks. Their flowers are white, red, crimson, scarlet, purple, yellow, and variegated. Flowers are solitary.

Mullein Pink.—[*Lychnis coronaria.*] Native of Europe; cultivated here. The plant is covered with a cottony substance, which the ancients used for lamp-wicks. It has ten stamens and five pistils. Flowers crimson, or purple. It has some resemblance to *Corn-cockle*, a plant found in wheat-fields.

Ragged Robin.—[*Lychnis Flos-cuculi.*] Sometimes called the "Cuckoo-lychnis." The flowers are of a light pink color; the petals are cleft into long, sharp teeth; calyx brown.

Scarlet Lychnis.—[*Lychnis Chalcedonica.*] Common flower in country gardens. It grows in a flat-topped cluster; flowers small and bright scarlet. Petals are indented. Native of Russia.

Virginia Catchfly.—[*Silene Virginica.*] The name of "Catchfly" was given from the sticky, downy substance which covers it, and by which small insects are often caught. This species has long, slender petals, cleft at the ends, and of a crimson color. Found in the open woods of the West and South.

Garden Catchfly.—[*Silene Armeria.*] A garden flower, sometimes called "Sweet-william." Stem about one foot high, branching, and bearing bunches of bright pink, or purplish flowers. Petals notched.

Royal Catchfly.—[*Selene regia.*] A large flower, of beautiful scarlet color, when cultivated. Found on prairies from Ohio south. Grows three feet high.

Bouncing Bet.—[*Saponaria officinalis.*] Sometimes called "Soapwort," from the fact that the juice of its root and stem will form a soap-like lather. Flower of pale pink color, usually double; petals notched. Often found wild by the roadside.

CHICKWEED.—[*Stellaria media.*] Sometimes called "Starwort." The well-known garden weed which is given to Canary birds. It has a small, white flower. Leaves egg-shaped.

SPURREY.—[*Spergula arvensis.*] Leaves grass-like, growing in a circle around the stem. Has an open cluster of small, white flowers. Found in grain-fields. Sometimes cultivated in Europe for feeding sheep.

The Rose Family [*Rosaceæ*] contains our most beautiful flower, the *Rose*, of which there are several hundred varieties; also, our most delicious fruits, as the *apple*, *pear*, *quince*, *peach*, *plum*, *cherry*, *apricot*, *nectarine*, *strawberry*, *blackberry*, *raspberry*, *almond.* The plants belonging to this order embrace trees, shrubs, and herbs.

The *Rose Family* contains three great divisions or groups, viz., *The Rose Group*, *The Plum Group*, *The Pear Group.*

The Rose Group comprises shrubby, prickly bushes, with leaves of the feathered or pinnate form, each composed of from three to nine egg-shaped or ovate leaflets. Its blossoms, in a wild state, have five petals, many stamens, and several pistils. When cultivated, the number of petals becomes numerous, the flowers beautiful, and of various *tints*, from white to a rich crimson.

The raspberry, blackberry, and strawberry belong to the Rose group. It will be seen that the form of their flowers, their parts, etc., resemble the corresponding parts of the Wild Rose.

DAMASK-ROSE.—[*Rosa Damascena.*] This beautiful rose is a native of the countries about the Mediterranean Sea. It has many petals, with colors varying from a delicate roseate hue to a rich rose-red. It is very fragrant, and its petals are used for making "*attar of roses.*" The bush grows from three to five feet high. It is cultivated in our gardens. The low monthly rose is a variety of this kind.

WILD ROSE.—[*Rosa lucida.*] This rose is sometimes called the "Dwarf Wild Rose." It grows on a bush from one to three feet high, in fields and in woods. The flowers are small, of a pale, red color, and grow in clusters of two or three. The leaves have a shining appearance, and grow with five to nine on a stem.

SWEETBRIER.—[*Rosa rubiginosa.*] This is sometimes called "Eglantine." The sweetbrier is a stout, prickly shrub, from four to six feet high, growing in fields and by roadsides. The flowers are usually solitary, with five rounded petals, of a light rose-color, and fra-

grant. The leaves are small, and usually have sacs or glands on the under side, containing an aromatic fragrance, which gives a delightful perfume when the leaves are rubbed.

French Rose.—[*Rosa Gallica.*] This is the common red-rose of gardens, from which have originated some three hundred varieties: among these are the "Carmine," "Carnation," "Velvet," "Nosegay," "York and Lancaster," etc. The numerous inner petals of the rose are developed from the stamens by cultivation. The dried petals of this rose are sometimes used in medicine. The pure tincture of rose, used for flavors in cooking, is made from the petals of this rose.

Black Raspberry.—[*Rubus occidentalis.*] This is sometimes called "Thimbleberry." The black raspberry bush grows along the borders of fields, and consists of a group of curved, slender stems, from four to six feet high. The leaves are egg-shaped, growing in clusters of three. Flowers white, with five petals. Fruit purplish black, of hemispherical shape, and when picked has a deep, hollow place where it was attached to the fruit stem.

Blackberry.—[*Rubus villosus.*] This well-known bush grows from one to six feet high, consisting of slender stems, covered with strong prickles. Leaves egg-shaped, from three to five in a group. Flowers, with five white petals, often growing in a cluster. Fruit black, globular, or slightly conical.

Strawberry.—[*Fragaria vesca.*] This well-known plant has white flowers, with five petals. The seeds grow on the surface of the fruit.

Pear Group.—The *Pear* group includes the pear, apple, quince, chokeberry, mountain-ash. The blossoms have five roundish petals, of a white or pink color, and grow in clusters.

Pear.—[*Pyrus communis.*] This delicious fruit is a native of Europe; but in its wild state the fruit is small and unpalatable. Flowers scentless, five white petals, with purple anthers. Fruit tapers toward the stem.

Apple.—[*Pyrus malus.*] The common apple was originally brought from Europe. The tree grows from twenty to thirty feet high. Leaves long, egg-shaped. Flower-buds pinkish; the five wide-spread petals are partly white, with tints of pink and light purple, and fragrant. There are also several native, wild species of apple in this country.

Quince.—[*Cydonia vulgaris.*] This is a small tree, so named from a city of Crete, from whence it was obtained. The oval leaves have

a cottony surface beneath. The fruit has a similar surface. It is hard, pear-shaped, of a yellowish color, and is used for preserves. The flowers have five petals, yellowish white, or very pale rose-color. The quince is supposed to be the "Golden Apple," celebrated in ancient fable.

Plum Group.—The *Plum* group includes the plum, peach, nectarine, apricot, cherry, and almond. The blossoms are white, or rose-colored, and consist of five petals, and from fifteen to thirty stamens. The fruit is fleshy, and contains a stone, or nut. The kernel of some of this group, as the peach and almond, contains *prussic acid*, a deadly poison.

PLUM.—[*Prunus domestica.*] Said to be a native of Italy. Tree about fifteen feet high. Leaves dark green. Flowers solitary, with five whitish petals, twenty to thirty stamens, with yellowish anthers. Fruit has a smooth skin of various colors, a fleshy pulp covering a small, flattened stone, with sharp edges. *Prunes*, as used on the table, are large plums dried.

PEACH.—[*Persica vulgaris.*] This well-known tree was named from its native country, Persia. Its leaves are lance-shaped. The flowers appear before the leaves, with five spreading, rose-colored petals. The skin of the fruit has a woolly coating. The fruit contains a rough "stone," or nut, which encloses the seed. There are many varieties.

CHERRY.—[*Prunus cerasus.*] This is named from *Cerasus*, an ancient town in Turkey, from whence the garden-cherry is supposed to have originated. Flowers large, with five petals, white, tinged faintly with purple. The leaves and flowers appear about the same time. Fruit round and reddish, has a fleshy pulp covering a round stone, or "pit."

POISONOUS PLANTS.

Crowfoot Family.—[*Ranunculaceæ.*] This family contains many dangerous plants. All the members possess an acrid or bitter juice, which is watery or colorless, and more or less narcotic; while some of them are absolutely poisonous. In some of these plants their poisonous properties may be dissipated by a boiling heat, or by drying in the sun.

Their leaves are usually palmately or ternately lobed, and without stipules. Many plants cultivated for ornament belong to this fam-

ily, as Anemone, Larkspur, Buttercup, Christmas-rose, Columbine, Monk's-hood, Clematis, etc. Owing to the poisonous character of some, and the suspicious properties of others, it would be well to be cautious in relation to all the plants of this family.

CROWFOOT.—[*Ranunculus sceleratus.*] This plant grows in wet places, from Georgia to Canada. It grows about fifteen inches high, and blossoms in June and July. It bears a small, bright yellow flower, with five petals growing singly on a slender stem. The seed-vessels form an erect, rounded cone. Leaves are three-parted. *The juice, when fresh, is very acrid,* and will raise blisters upon the skin. *It is a poison when taken internally.* Cattle avoid this plant when it is fresh.

MONK'S-HOOD.—[*Aconitum Napellus.*] This plant is common in old gardens and waste places. It grows from three to four feet high, bearing a cluster of blue, helmet-shaped flowers. The name Monk's-hood was given from the shape of the upper portion of the flower. The leaves are deeply-cut, and several times divided, after the manner of those of the common larkspur. The seed-vessel consists of three lobes. *The root is very poisonous,* tuberous, or shaped somewhat like that of the horse-radish, for which it is sometimes mistaken in the early spring, before the leaves appear. It should not even be touched by the tongue. This plant is also called *Wolf's-bane,* because in Europe it is used for poisoning wolves.

BANEBERRY.—[*Actea spicata.*] This plant is found in rich woods; grows about two feet high; leaflets ovate and sharply cleft; blossoms in May and June; berries red or purplish, and about the size of currants; seeds smooth and flattened. *Berries poisonous.*

BLACK HELLEBORE (CHRISTMAS-ROSE).—[*Helleborus niger.*] This plant received the name of Christmas-rose because in the warmer parts of England it blossoms in the winter and early spring. It has large single white flowers, which turn pinkish, then green. In form the blossom somewhat resembles that of the strawberry. The leaves are pedate, and of a shining green. It is cultivated in gardens, though not very common in this country. Its injurious properties should be known, that its serious effects may be avoided.

Parsley Family. — POISON-HEMLOCK. — [*Conium maculatum.*] Found in the Northern and Middle States by roadsides, in waste ground, and swampy places. Grows from three to six feet high; has very smooth stems, with purplish spots; leaves are lance-shaped and coarsely-toothed, sometimes pointed; flowers white and small,

growing in close clusters at the ends of the stems, like the *water-hemlock;* blossoms in July and August; fruit somewhat egg-shaped and ribbed. *Root a deadly poison.*

The entire plant emits a very offensive odor when bruised. Supposed to be the plant which the ancient Greeks used to destroy the statesmen of whom they were tired. This plant was introduced into this country from Europe.

WATER-HEMLOCK.—[*Cicuta maculata.*] This plant is a native of our country, and is found in swamps and wet places; even within the limits of villages and cities it is far too common for safety. It is a tall, rank herb, growing from four to six feet high. Its stems are hollow, branching, smooth, and streaked with purple and brown; the flowers are white, growing in clusters, which spread out like an umbrella. The veins of the compound leaves terminate in the notches; it blossoms in July and August. Fruit or seeds nearly round, with ribs, the channels between which are of a reddish-brown color, and filled with oily matter.

Children often mistake it for sweet-cicely, which belongs to the same family. Its herbage is dangerous to cattle. *The fleshy root is fatally poisonous.* It is said that a drachm of the fresh root has killed a boy in less than two hours after eating it.

FOOL'S-PARSLEY.—[*Æthusa Cynapium.*] This plant was originally introduced from Europe. It is sometimes found about cultivated grounds, but usually in waste places. Grows from one to two feet high, having a hollow stem, and dark-green, lance-shaped leaves. The flowers are white, growing much like those of the hemlock and wild parsnip; blossoms in July and August. Fruit or seed nearly as broad as long, with prominent, straight ribs. This plant is not only poisonous, but has a fetid odor. *Leaves, seeds, and roots poisonous.*

WILD PARSNIP.—[*Pastinaca Sativa.*] Grows wild in fields, by fences, roadsides, etc. Has a tall, grooved, branching stem; leaves pinnate and deeply cut. Flowers, which appear in July, are yellow and small, growing in fine clusters, at the ends of seven or eight spreading umbels. Fruit flat, oval, with a broad, single-winged margin. *The root is spindle-shaped*, and well known in its cultivated state as a sweet-flavored esculent; but in its wild state the root becomes smaller in size, hard, acrid, and *poisonous.*

Lobelia Family.—LOBELIA (INDIAN TOBACCO).—[*Lobelia inflata.*] This plant is found in dry, open pastures, and by roadsides. It grows from ten to fifteen inches high. Leaves elliptical, hairy. Flowers small, pale blue, and growing in leafy spikes. Blossoms

from July to September. Leaves and flowers grow from the same axil. Juice milky and acrid. This plant is used as a medicine, but its poisonous qualities render it very dangerous.

Figwort Family.—Foxglove.—[*Digitalis purpurea.*] Cultivated in gardens for its showy flowers; also by the Shakers and others for its leaves, which are dried and used as medicine; but, owing to its poisonous properties, this plant should be used *only* by those having a clear knowledge of it. The plant grows from three to four feet high; flowers from two to two and a half inches long, rather hairy within, and beautifully spotted with deep purple dots, surrounded by white rings. The common name—"Foxglove"—is said to have been derived from an old Saxon word, *Folks-glove.* It is a native of Europe and Asia.

Pine Family.—Yew.—Ground Hemlock. [*Taxus Canadensis.*] American Yew. [*Taxus baccata.*] English Yew. The American Yew is a small evergreen shrub, from two to four feet in length, growing as a straggling, prostrate bush, never forming an ascending trunk. It is found in thin, rocky soil on hill-sides, near streams, and along moist banks, particularly in the shade of evergreen-trees. Leaves nearly an inch long, arranged in two opposite rows on each side of the branchlets. The blossoms are like scaly buds, and appear in May. Fruit is of a coral red, and displays a black seed at the top.

The leaves of this plant and *the black seeds* of the berries *contain poison.* The pulp of the berries is not considered unwholesome, but it is dangerous to swallow the black seeds.

Mezereum Family.—Mezereum.—[*Daphne mezereum.*] This shrub belongs to the same family as the common "Moosewood," or "Leatherwood," and is also noted for its fibrous, tough bark. It is cultivated for ornament; grows from two to three feet high; leaves of a delicate green; flowers of a purplish rose-color, growing around the stems. These are succeeded by *scarlet berries* which *are poisonous.* The root and bark are acrid and caustic. Blooms early in spring. A native of Europe.

Sumac Family.—Poison-ivy.—[*Rhus toxicodendron.*] (Sometimes known as "Poison-oak," and occasionally as "Poison-vine.") A plant common in low grounds, climbing on fences, over rocks, and ascending trees. The variety which ascends trees, from twenty to forty feet in height, is usually designated as *Rhus radicans.* Its leaves are generally nearly entire. The stem of this variety sometimes attains the size of one or two inches in thickness. It is cov-

ered with a grayish, scaly bark, and fastens itself to the object upon which it climbs by numerous bunches of rootlets thrown out along the stem.

The leaves of the poison-ivy are of a shining green color, and change in autumn to a bright yellow, or orange, or a mahogany; they always *grow in groups of three;* are ovate, with margins variously shaped, from nearly entire to undulate, dentate, and cut-lobed, and are downy underneath. Flowers are small, greenish yellow, and grow in long, loose clusters. Blooms in May and June.

The juice of this plant is very poisonous to the touch. It causes an eruption of the skin, accompanied by an intolerable itching and burning sensation.

The poison-ivy is sometimes mistaken for the Virginia creeper, a harmless plant which often is cultivated and known as "woodbine." Attention to the following distinguishing characteristics of each vine will prevent these mistakes.

Virginia Creeper—leaves grow in groups of five; are large, oblong, and pointed, margins sharply dentate; color, dark green, changing in autumn to a bright crimson; berries dark blue, smaller than pease; stem fastens, in climbing, by *tendrils.*

Poison-ivy—leaves grow in groups of three; are ovate, with margins variously shaped; color, shining green, changing in autumn to a bright yellow or orange; berries vary from a dull white to a pale, shining brown; are about the size of small pease; stem clings by bunches of small *rootlets.* Poison-ivy is found from Georgia to Canada.

Poison Sumac.—[*Rhus venenata.*] (Sometimes called "Poison Dogwood.") A shrub or small tree, common in swamps, growing from six to eighteen feet high; bark gray, and generally smooth. Each leaf-stem has seven, nine, eleven, or thirteen green leaflets, arranged in pairs on opposite sides of the red stem, with a single one at the end. The leaflets are smooth, oblong, abruptly pointed, margins entire, from two to three inches long and about half as wide.

The color of the leaves changes in autumn from green through a bright yellow to crimson and scarlet; but the leaf-stem, or mid-vein, remains an intense red during all these changes. The flowers are small and greenish, growing in alternate clusters on a long stem. The fruit is of a greenish yellow, dry, smooth, and shining, and about the size of small pease. Blossoms appear in June; berries ripen in September.

The entire plant is very poisonous to the touch or taste, and even taints the air around it, so that some persons become poisoned by

simply passing near it when in a state of perspiration. The poison produces painful swelling, inflammation, and intense itching.

The *Mountain Sumac*, a small shrub, growing in dry, rocky places; bearing a dark-green leaf, shining on the upper surface; greenish red flowers, in dense clusters, on a long stem; fruit seed-like, red and hairy; is not poisonous.

Nettle Family.—STINGING NETTLE.—[*Urtica dioica.*] Common in waste places and by roadsides; grows from two to three feet high; stem four-sided; leaves from two to three inches long and about one-half as wide, and downy underneath; have short stems attached to opposite sides of the stalk; margins deeply serrate. Blossoms from June to August. The entire plant is covered with stiff, tubular hairs, which transmit a venomous fluid when pressed, causing a stinging and itching sensation.

Nightshade Family.—THORN-APPLE, *or* STRAMONIUM.—Jamestown weed. [*Datura stramonium.*] A common plant, having a rank odor, growing in waste places, among rubbish, etc. The stem is about three feet high, smooth, hollow, and branching. The general form of the leaves is ovate, but the margins are cut in sharp angles, with gashes rounded at their bases. The blossom is of a cream-white color, funnel-shaped, with a long tube, somewhat plaited, and a border fine-toothed. The general form of the flower resembles that of the morning-glory. The seed-vessel, or pod, is about the size of a small apple, somewhat egg-shaped, and covered with spikes. It contains numerous flat seeds. *Every part of the plant is poisonous.*

COMMON NIGHTSHADE—BLACK NIGHTSHADE.—[*Solanum nigrum.*] An ugly, weed-like plant, growing about rubbish, in shaded places, with angular branches and smooth stems, which commonly rest on the ground. Leaves usually appear as if partly eaten by insects. Flowers white, with a yellow conical centre, five-parted, grown in small, open clusters, on long stems. Blossoms during July and August. Berries are bluish black, round, and vary in size from large cherries to small pease. *These are poisonous.* The plant has a disagreeable odor.

DEADLY NIGHTSHADE.—[*Atropa belladonna.*] A plant which grows about five feet high, branching near the ground; the stem and large leaves have a purplish tinge; leaves narrow, oval, and pointed, growing in pairs from opposite sides of the stem, with a second pair of small leaves growing at the base of the lower large leaves. Blossoms are somewhat bell-shaped, of a pale purple, grow-

ing singly, also in pairs, from the stem at the foot of the leaves, and nodding. Berries are about the size of cherries, and change from a green color to a glossy black; are filled with a purple juice. These are exceedingly poisonous. The entire plant is dangerous. It is sometimes cultivated in gardens, and may occasionally be found growing in other places. It is a native of Europe; is used as a medicine.

HENBANE.—[*Hyoscyamus niger.*] A tall weed growing about rubbish of old houses, roadsides, and sometimes in old gardens. Stem round, branching, and about two feet high. Leaves large, oblong, pointed, and cut into sharp lobes, or deeply toothed. Blossoms of a dull yellow color, strongly veined with purple; they grow in one-sided spikes at the ends of the stems, from the foot of the leaves. The flower-cup is urn-shaped. The plant is hairy, sticky, of a sea-green hue, and emits an offensive odor. *The entire plant is poisonous.*

BITTERSWEET.—[*Solanum dulcamara.*] A shrubby climber; stem branching several feet in length; found on moist banks, near low ground, and around dwellings. The lower leaves are entire, the upper ones halberd-shaped. Blossoms bluish purple, drooping, with five pointed petals surrounding an orange-colored, conical centre. Each division or segment of the flower has two green spots at its base. Blossoms from June to September. *Berries* are oval, bright red, and *poisonous.*

Poppy Family.—CELANDINE.—[*Chelidonium majus.*] This plant grows by roadsides, fences, etc., about two feet high; stem is branching, and very brittle. Blossoms have four petals, are yellow, somewhat resemble the buttercup. Leaves consist of two to four pairs of leaflets, with an odd one at the end. Seed-pods an inch long. When broken, the plant exudes a yellow, strong-smelling juice, which is *poisonous.* It is sometimes applied to warts, to destroy them.

Arum Family. — JACK-IN-THE-PULPIT—INDIAN-TURNIP. — [*Arisæma triphyllum.*] A common plant in rich, low grounds in woods. The fleshy stem of this plant divides into two parts near the ground; each branch bearing three oval, pointed leaflets at its end. Between the branches grow the blossom and the fruit. The fleshy spike, around which the berries grow, is enclosed in a sheath-like leaf, green without, but within variegated with stripes of dark purple alternating with pale green. The form of this sheath is somewhat like that of a Calla lily, but with the point of the sheath bending over the cup containing the spadix or spike. When ripening, the berries, growing around the fleshy spike in an oblong cluster,

change from a green color to a bright scarlet. Blooms in May. Fruit ripens in August and September.

This plant has a bulbous or corm-like stem in the ground somewhat of a turnip shape, from the upper part of which there grow numerous fibre-like roots. The fleshy portion of the plant, when in a green state, is exceedingly acrid. Neither the bulbous root nor the berries should be tasted.

Heath Family.—SHEEP LAUREL.—[*Kalmia angustifolia.*] Sheep-poison, Lamb-kill, are names sometimes applied to it. This shrubby plant grows from two to three feet high, in damp grounds; leaves narrow, oblong, from one to two inches long, margin entire, surface smooth, color pale green. Flowers purplish crimson; corolla short, five-toothed, slightly bell-shaped; grow in clusters; blossoms from May to July. Leaves believed to be poisonous to sheep.

Mushroom Family. — FLY MUSHROOM. — [*Agaricus muscarius.*] The mushrooms spring up wherever there is sufficient heat and dampness, in rich soil or heaps of decayed vegetable rubbish. First there appears a little knob, within which the stalk is gradually formed. By-and-by the outer skin bursts, and leaves a fleshy stem supporting a fleshy cap, which, gradually enlarging, tears the lower skin which united it to the column, and opens like an umbrella.

The *Fly Mushroom*, with its crimson cap dotted with white, is beautiful but dangerous, for it is very poisonous. It is said that when steeped in milk it will kill flies.

Some varieties of mushroom are used for food; these are usually distinguished by their *pink* gills, and by a peculiar odor. It is, however, quite unsafe for any person not perfectly familiar with the appearance and odor of the edible mushroom to venture tasting any of this tribe.

Need of Illustrations.—Those who do not know the appearance and noxious qualities of poisonous plants are liable to serious accidents from tasting or handling them. Ignorance in relation to this matter is especially dangerous to children. These plants cannot be easily recognized by those who possess no acquaintance with botany, from descriptions alone. It is therefore exceedingly important that the young should be made sufficiently familiar with their *appearance*, by means of carefully-drawn pictures, to be able to distinguish such plants from harmless ones, and thus prevent liabilities to those accidents which occur from

handling and tasting these noxious members of the vegetable kingdom.

It is believed that a proper use of *illustrations* of poisonous plants, and of these descriptions, will enable any person to attain the necessary acquaintance to protect himself from the dangerous effects of such plants.

A series of twenty-four illustrations of the poisonous plants* described here has been carefully prepared, to represent both their shapes and colors. Each illustration is on a card of the size of common album photographs, and may be procured by mail.

Illustrations* of all the *leaves*, *flowers*, *roots*, etc., described in the preceding pages, have also been published on cards of the same size.

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MINERALS.

"Tongues in trees—books in the running brooks—
Sermons in stones—and good in everything."

SPECIAL attention is directed to minerals, and a few simple facts given here concerning them, for the purpose of pointing out still another field in which children may be led to extend their observations with pleasure and profit, and to increase both their powers of learning and their knowledge of the world in which they live. The chief aim now is to show how teachers may lead their pupils to take such notice of the common objects which may be found wherever they go, as to make them desire to know what the different stones have to tell about themselves, and about that part of the world where they are found.

Children may be easily induced to notice differences between the smooth, rounded pebbles by the brook-side, or on the shore of the lake or sea, and the rough, irregular stones that are found near a ledge of rocks. When they ask what made the stones so smooth, tell them how the swift-running water of the stream or the rolling waves of the sea rub the stones against each other, rolling them over and over, and thus wear off the corners and make them smooth. Tell them that their toy-marbles are made by breaking stones into small blocks, then placing a large number of them together, and by means of machinery rolling them against each other, round and round, while they are kept wet with water, and thus are worn smooth

and to the shape of marbles. Ever after these children will understand why some stones are smooth, and they will take more interest in looking at them.

Prepare Pupils to Observe Minerals.—Before sending your pupils out to look at stones and rocks, give them one or two lessons to teach them how to distinguish differences in them. Give the pupils good specimens of *quartz*, of *mica*, of *feldspar*, and of *granite*, to examine.

Quartz.—Lead them to notice the very hard, clear, glassy qualities of the *quartz;* that it cannot be scratched with a knife or a file; that it will scratch glass; that it breaks into irregular pieces—then let them try to find quartz in a piece of *granite.*

Mica.—Let the pupils notice the bright, glistening, tough, elastic, and almost transparent substance—*mica;* that it may be easily split into leaves thinner than paper; that it may be easily scratched with a knife—then let them find this substance in a piece of *granite.*

Feldspar.—Lead the pupils to notice the white or flesh-colored substance—*feldspar*—which breaks with a bright, even surface, and in two directions; that it is not quite so hard as quartz, yet too hard to be scratched with a knife; that it may be scratched by the quartz—then let them find the feldspar in a piece of *granite.*

Now the pupils will be prepared to go into the fields and along the roadside to look for each of these minerals—*quartz*, *mica*, *feldspar*—and for the rock called granite, which is composed of these three. When they have gathered their specimens, the teacher may assist them in correcting any mistakes made in distinguishing either of the minerals.

Sandstone.—At a subsequent lesson tell the pupils that quartz, when pulverized or made fine, forms *sand.* Let

them examine coarse sand, and notice the fine grains of quartz in it. Show them a specimen of *sandstone*, and let them see that it is made up of small grains of sand; that by scraping the sandstone with a knife the small grains can be separated; that these grains are not all of the same size, nor all composed of the same glass-like substance; that some of them are softer than others, and seem like a kind of hard cement which fastens all these grains into a solid stone. Now let the pupils examine the sand and gravel in a brook, or on the shore of a lake, or the beach of the ocean, and be told that sand and gravel are formed by the motion of the water, which causes stones, pebbles, gravel, and sand to move about, and thus keep the pieces continually rubbing against each other, and grinding them smaller and finer.

The pupils may now be told that *sandstone* is formed by layers of fine sand deposited in deep water, and then pressed together by the weight of the sand and water more and more firmly from year to year; and that after a very long period of years these layers of sand become solid rocks.

Calcite. — A common form of crystallized calcite is called *dog-tooth-spar.* Calcite, in a rock form, is *limestone.* When burnt, it is *carbonate of lime* (the material that is slacked in water and used for making mortar). Calcite is easily distinguished from feldspar and other minerals by its effervescence with acid; by its being easily scratched with a knife; by its infusibility in the hottest fire; and by its cleavage in *three* directions, and with rhombic faces.

Dolomite. — When limestone contains magnesia mixed with the lime, it is called *magnesian limestone*, or *dolomite.* Dolomite and calcite appear much alike; but dolomite does not effervesce freely with acid unless the acid be hot.

Chalk is limestone. **Marble** is limestone; but sometimes it is of the magnesian kind. Calcareous rocks are kinds of limestone. Limestone, in its various forms, has dull colors, from white—through gray, yellow, red, and brown—to black. It is very abundant in this country, except in the form of chalk. Chalk is found in large quantities in England and France.

Show your pupils specimens of *calcite* in the forms of limestone, marble, carbonate of lime, and crystals. Lead them to experiment with these, and observe the several characteristics by which this mineral may be distinguished from feldspar and other minerals. They will then be prepared to collect specimens of rocks, to examine them, experiment with them, and determine whether they belong to either of the classes of minerals or rocks already named—*quartz*, *mica*, *feldspar*, *sandstone*, *calcite*, etc.*

These and similar lessons on minerals may be extended so as to include those to be found within the regions that may be visited by your pupils. Indeed, these and other lessons intended to introduce children to nature, and induce them to become interested in studying the charming pages illustrated with real minerals and rocks, plants, blossoms, and fruits, and all the varieties of animal form and life, should begin at the home of the young learner, and with things within his easy observation.

That you may do this intelligently, make yourself acquainted with the character of the rocks and minerals in the vicinity of your school; then teach your pupils how to distinguish or know the different kinds, and tell them where each may be found. By such means many boys have been led away from idleness and bad associations,

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* Teachers and older pupils who desire to learn more about minerals and rocks will find the following books very useful: *Hooker's Mineralogy and Geology; The Geological Story Briefly Told*, by Dana; *Science Primers*, *on Geology*, *and on Physical Geography.*

and the foundations laid for observing and studious habits, and lives of great usefulness.

Try what virtue there is in developing a love for minerals, plants, and animals, and in after years many will bless you in remembrance of valued instruction, and the numerous sources of happiness unfolded to them.

CHEMISTRY; OR, ELEMENTS OF SUBSTANCES.

From the lessons under the head of "Properties of Objects" you learned to distinguish three classes of substances—*Animal*, *Vegetable*, *Mineral*. The succeeding lessons on animals and on plants furnished you additional facts concerning the first two of these groups. I now propose to direct your attention still further to the class called *Minerals*, and, while guiding your observations upon this group, to point out some new facts which will give you a better knowledge of all kinds of substances.

You have learned that *a mineral has no life, no feeling, no motion, and does not take food;* and yet the mineral supplies food to the vegetable world, and the vegetable world furnishes the food for the animal world. Thus, while this substance has no life of its own, it supplies the materials for life to the other two classes.

How can this be true, when minerals are such things as stones, sand, clay, iron, lead, silver, etc.? you may inquire. I will try to explain this matter.

All the words that you know and can read or write, and all the words in the books, are made up of letters. When you learn to write a word, you know what letters make the word, and how they are arranged. In our language there are only twenty-six letters, and these enable us to make up more than one hundred thousand words. These letters are the elements of our written language.

Minerals, like written words, are made up of elements. All the matter that constitutes all the rocks, stones, iron, gold, silver, lead, clay, ice, and water in the world is made up of elementary substances, which are the letters of nature. There are about sixty-three of these mineral-letters. As the letters of our language, by different combinations, form different words, so these mineral elements, by different combinations, form different substances.

Some of these mineral-letters cannot be seen when alone, or not united with one or more other letters. This group of mineral-letters we call *gases.* Some of these letters can be seen, felt, and tasted; these are called *liquids* and *solids.* Some of the solids we call *metals*, and some we call *minerals.*

I will write the names of a few of these mineral-letters in groups, and thus show you what some of them are called, and to which group they belong:

MINERAL-LETTERS.

Gases.	Solids.	Minerals.
Oxygen,	*Carbon,*	*Iron,*
Nitrogen,	*Sulphur,*	*Silver,*
Hydrogen,	*Phosphorus,*	*Potassium,*
Chlorine,	*Silicon,*	*Sodium,*
Fluorine.	*Iodine.*	*Calcium.*

These mineral-letters are commonly called *Elementary Substances.* All the matter that constitutes the rocks, land, water, trees, grain, and animals of the whole earth is made up of these letters of nature. The names of only *fifteen* of them are given above, yet these elementary substances constitute more than one-half of all the matter in the world, including animals, vegetables, and minerals. One of these elements — *oxygen* — is the most abundant one in nature. It comprises one-fifth of the air we breathe, eight-ninths (by weight) of the water we drink, more than two-fifths of the land we walk on, and a large part of the food we eat, as well as of the clothing we wear, of the houses we live in, and of the tools we use.

In our written language the letters form words, the words are combined into sentences, and the sentences into language as a whole. In nature the mineral-letters, or simple substances, form the mineral-words of nature; and these words of nature are combined into the three great sentences of nature—*minerals, vegetables, animals;* and these three groups, or books, of nature comprise the whole world of matter. A knowledge of these elements, and of their laws of combination, is called *Chemistry.* By a care-

ful study of this science you may learn the composition and nature of all the materials of which the world is made up.

As in our language some words contain only one letter, or element, while some words contain two letters, others three, four, five, or more letters, so it is in these words of nature, some substances contain only one letter, or element, some contain two elements, some three, four, five, or more elements. As each word in our written language is complete in itself, and has a definite meaning, so each of these words of nature is complete of itself, and is known as a definite substance, with its own distinct properties.

I will now give you the names of a few of the words of nature, and tell you what letters or elements form them:

Substances with one Element.—*Silver*, *iron*, *sulphur*, *carbon*, or *charcoal*, are each words containing only one letter, and the name of the letter in each case is the name of the substance, just as the names of the letters A, I, and O are the names of the three words which they constitute.

Substances with two Elements.—*Air*, *water*, *sand*, and *salt* are each words containing only *two* different *letters*, or *elements*. The name of each element in these substances is as follows: **Air** is composed of *oxygen* and *nitrogen;* **Water** is composed of *oxygen* and *hydrogen;* **Sand** is made up of *oxygen* and *silicon;* **Salt** is made up of *sodium* and *chlorine.*

Substances with three Elements.—The following substances contain each *three elements*, or letters, as follows: **Sugar** contains *oxygen*, *hydrogen*, and *carbon;* **Starch** contains *oxygen*, *hydrogen*, and *carbon;* **Glycerine** contains *oxygen*, *hydrogen*, and *carbon;* **Vinegar** contains *oxygen*, *hydrogen*, and *carbon.*

It will be noticed that each one of these substances contains the same elements. In some written words the same letters are repeated, so in some substances the same elements are repeated several times. Sugar contains more than twice as much *oxygen* and *carbon* as starch does. Glycerine contains less of each *oxygen*, *hydrogen*, and *carbon* than either sugar or starch, but more of each of these elements than vinegar.

Substances with four Elements.—Each of the following substances contains *four elements*, as follows: **Gun-cotton** is composed of *oxygen*, *hydrogen*, *nitrogen*, and *carbon;* **Cream of Tartar** is composed of *oxygen*, *hydrogen*, *carbon*, and *potash;* **Bronze** is composed of *copper*, *tin*, *zinc*, and *lead.*

Substances with five Elements.—Each of the following substances contains *five elements*, as follows: **Gunpowder** is composed of *oxygen*, *nitrogen*, *sulphur*, *carbon*, and *potassium;* **Alum** is composed of *oxygen*, *hydrogen*, *aluminum*, *potassium*, and *sulphur.*

As in our written language you must know how the several letters are combined, and how many times any or each of those letters are repeated in the same word, so in these words of nature you must learn how these simple substances are combined, and how many times each is used in the same substance before you can understand how these combinations of the same elements can produce such different substances. All of these facts about the combinations of elementary substances to form all things that we can see, smell, taste, or feel, you may learn by the study of *chemistry.**

A knowledge of this science is useful in all the occupations of life, and is indispensable to the chemist, the physician, and to success in many kinds of manufacturing. It is valuable to the farmer, to the merchant, to the miner, and the house-keeper.

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* Teachers and students will find the following books useful for elementary instruction on this subject: *Hooker's First Book of Chemistry;* also *Hooker's Second Book of Chemistry, or Science for the School and Family;* and the *Science Primer of Chemistry.*

OCCUPATIONS AND TRADES.

ALL who are to become actors, and not mere lookers-on in the world, should be so instructed that they may understand the nature and purpose of the most important things and occupations around them. Children like to learn additional facts about things, places, and occupations of which they have seen and know but little; but to so learn that their knowledge shall become of practical value, they need to be guided by parents and teachers. Among the most useful lessons learned are those which the real teacher prepares the pupils to understand, and stimulates them to learn by their own observation and experience outside of the school-room.

Children who have had their attention thus directed to different occupations will thereby gain knowledge that will prove useful to them in many ways in later years. When the boy comes to decide upon the business for his life, he will have something to aid him in determining what he would like to do.

The boy whose attention has been specially directed to the work performed, and to the articles produced by the different occupations, will learn readily the duties of his position. He will be able to perform them with such intelligence as to command better wages than one whose education has not been thus practical.

It is hoped that the following lessons, facts, and suggestions to teachers will aid in accomplishing a work of great value to their pupils. The successful teacher aims to connect the lessons of the school-room with the children's ex-

periences of out-of-school life, thus making the instruction interesting, practical, and most effective. The lessons about what people do furnish excellent opportunities for accomplishing this purpose.

Play Exercises.—Simple exercises might be commenced with quite young pupils, and made the means of training them in the use of language. They could be introduced under some such titles as the following: "Plays at House-keeping," "Plays at Store-keeping," "Plays at House-building;" and thus, in aid of instruction, advantage may be taken of that characteristic of childhood which leads the young to want to play in imitation of what they see older people do.

Suppose the girls play "Set a Supper-table." One might say, "I will put on the table-cloth;" another, "I will put on the plates;" others, "I will put on the knives and forks;" "I will get the cups and saucers;" "I will make the tea;" "I will get the bread, and cut it;" "I will bring the butter;" "I will bring the cake, and cut it;" "I will put on the cheese;" "I will get the teaspoons;" "I will put on the preserves;" "I will put the napkins by the plates;" "I will place the chairs around the table;" "Let me bring the cream and sugar for the tea;" "I will bring the water and the tumblers."

Each pupil, in another exercise, might say what she would like for supper, or breakfast, or dinner, according to the meal that was being represented. The exercise might be varied by each telling what to put on the table (appropriate to the given meal), as if directing a servant to do it.

When the setting of the table has been completed, the teacher might preside, and request each pupil at the play-dinner to tell what kind of meat, vegetables, etc., she would like. By this means many useful lessons in table-manners may be taught. The exercise of good judgment and tact by the teacher will render such exercises exceedingly interesting and profitable to children.

The boys might play "Keeping Grocery." Let one pupil represent a customer, the next one the grocer, the next a customer, the next the grocer, etc., somewhat as follows: "Have you nice

eating-apples?" "Yes; would you like some?" "I will take two quarts."

"Please give me two pounds of your best tea." "Here is your tea; the price is one dollar and a half for the two pounds."

"What is the price of your best butter?" "Twenty-five cents." "I will take two pounds."

"How much do you ask for good potatoes?" "Twenty cents a peck." "You may send me one peck."

"Please give me three and a half pounds of powdered sugar."

"I would like a pound of crackers."

"I wish half a pound of cheese," etc., etc.

During these exercises the pupils are supposed to speak in turn, or by permission of the teacher, after expressing their readiness by holding up a hand.

The range of appropriate topics may be increased as the pupils become familiar with the plan of proceeding. These exercises may be made a means both of recreation and useful instruction at the same time, and may be introduced from time to time, say once a week, in some form, until the pupils are able to take up lessons of a more advanced character, in which a wider range of observation will be developed.

Older pupils should have more advanced lessons, which might be conducted somewhat in the following manner:

What People Do.—To-day we will talk about what people do to earn a living. You know that some people keep stores, and sell things; some have shops, and make things; some print books; some bind books; some sell books; some make clothes; some make furniture; some make wagons; some make bread and cake; some teach school; some preach; some go to see people when they are sick; some make and sell medicines; some supply us with meat; some build houses; some raise wheat, corn, and other things for our food; and many people do other kinds of work for a living. We call that which people do for a living their business, or *occupation.*

The Names of Occupations shall be our lesson for to-day. I will write the word *occupations* on the blackboard, and as each

pupil in turn names some occupation, I will write the word under this on the blackboard. The pupils may copy these words on their slates.

[The teacher writes the words as given by the pupils, arranging them in columns. At the close of the exercise many of the words in the following list will have been written :]

OCCUPATIONS.

Farmer,	Merchant,	Cooper,	Dentist,
Gardener,	Milliner,	Turner,	Druggist,
Miller,	Dress-maker,	Jeweller,	Editor,
Baker,	Mason,	Saddler,	Printer,
Grocer,	Carpenter,	Sailor,	Paper-maker,
Butcher,	Glazier,	Musician,	Bookbinder,
Tailor,	Painter,	Teacher,	Bookseller,
Hatter,	Upholsterer,	Clergyman,	Lithographer,
Tanner,	Cabinet-maker,	Physician,	Engraver.
Shoemaker,	Blacksmith,	Lawyer,	

When the pupils have mentioned all the occupations they can think of, instead of telling them the names of others, the teacher may request them to notice what they see people working at, after they go home from school.

For the second lesson on occupations, let the pupils take their slates, and each one write the names of all the occupations that he can remember. To ascertain what names have been written, and which pupil has the greatest number, one pupil may read his list, and each other pupil check on his own slate the names read, with a cross thus × for each name read, that he has written. When the pupil has finished reading his list, let those who have other names read them, and finally have a complete list written on the blackboard.

As this exercise affords excellent practice in spelling, it may be repeated two or three times with profit. During the repetition of the exercise, each pupil should write his list without copying from other pupils. As a conclusion, ascertain which pupil has

written the most names of occupations, and which one has spelled the greatest number correctly.

For a subsequent lesson, let the pupils choose one of the occupations named as a subject for a lesson that shall require a more careful observation concerning it. Suppose the pupils choose that of the *tailor*. The teacher may write the word *Tailor* on the blackboard, and the following heads:

What he uses.	**What he does.**
Garments made.	**Names of their parts.**

Request each pupil to write these heads on his slate, leaving spaces for several words under each, and then to write names of things used, work done, garments made, and of their parts under the proper head. Let the lists formed by the pupils be compared as before, and a complete list placed on the blackboard, which might be nearly like the following:

TAILOR.

What he uses.	**What he does.**
Measure,	Finds the size,
Cloth,	Cuts,
Shears,	Sews,
Needles,	Makes clothes,
Thread,	Fastens the seams,
Wax,	Makes the thread smooth,
Thimble,	Pushes the needle,
Goose,	Presses the seams,
Board,	Holds the cloth for pressing,
Water.	Moistens the seams.

Garments made.	**Parts of garments.**	
Pantaloons,	Back,	Front,
Vest,	Collar,	Cuff,
Coat,	Sleeve,	Leg,
Overcoat,	Button,	Button-hole,
Cloak.	Pocket,	Skirt.

Exercises with these lists might be repeated two or three times, until the pupils become familiar with the spelling of each word.

The lesson might be extended by requesting the pupils to give the names of the kinds of cloth used by the tailor, as *beaver*, *cassimere*, *doeskin*, *broadcloth*, *satinet*, *melton*, *tweed*, *flannel*, *velvet*, *corduroy*, *duck*, *satin*, *serge*, *silk*, *silesia*, *hair-cloth*.

Subsequently the pupils might answer the following questions, orally or in writing: *What* do tailors measure? *Why* do they measure? *What* do they cut? *When* do they baste? *What* do they press? *Why* do they press? etc. *Where* do tailors obtain their cloth? *What* do they produce? How do they procure their food?

At another time the trade of a shoemaker may be chosen as the subject of the lesson, and then the blackboard might contain something like the following:

SHOEMAKER.

What he uses.	What he does.
Cowhide, calf-skin,	Measures, cuts, pastes, lasts,
Morocco, sole-leather,	Pegs, tacks, sews, stitches,
Knife, awl,	Fits, trims, foots, taps,
Float, tacks,	Mends, caps, half-soles,
Wax, shoe-thread,	Pounds leather,
Pincers, pegs, nails,	Soaks leather,
Last, strap, hammer.	Blacks, trims, polishes.

Parts of a shoe.	Parts of a boot.
Toe, heel, sole,	Leg, front, or vamp,
Shank, quarters,	Heel, toe, instep, shank,
Tongue, lining, insole.	Counter, seam, straps.

Kinds of Boots, Shoes, etc.—Heavy boots, riding-boots, fine, calf, patent-leather, Congress gaiters, Oxford ties, shoes, slippers.

What do shoemakers measure? cut? paste? peg? sew?

Why do they measure? paste? peg? sew?

Why do they sew instead of peg?

Why do they hammer leather?

Why do they use wax?

Where do they obtain leather?

What is leather made from?

Who makes the leather?

What do shoemakers produce?

How do they procure food and clothing?

It is important that the teacher shall so conduct these lessons as to make them profitable exercises in spelling and in the use of language.

OTHER LESSONS ON OCCUPATIONS.

For the purpose of aiding teachers in preparing other lessons on trades and occupations, the following lists of *materials and implements used*, *kinds of work done*, and *articles produced*, are given under appropriate heads, with suggestions as to methods of giving the lessons. It is expected that these lists, etc., will be arranged by each teacher so as to adapt the work to each special class of pupils. Let the teacher take the materials, profit by the suggestions, but make each lesson for his own class.

Allow me to add in this connection that these lessons will become much more interesting to the pupils, as well as more profitable, if the trade or occupation is illustrated by suitable pictures. Excellent illustrations have been prepared for purposes of teaching, which represent tools used, persons at work with them, and articles produced by each of the following trades and occupations:*

* *Prang's Aids for Object-teaching*—Trades and Occupations, illustrated in colors; each picture 22 by 14 inches; with a Manual of Directions, by N. A. Calkins.

Carpenter,	*Tailor,*	*Printer,*
Blacksmith,	*Baker,*	*Lithographer,*
Shoemaker,	*Gardening,*	*The Farm-yard,*
Tinsmith,	*The Kitchen,*	*Hay-making.*

FARMER.

What he uses.	What he does.	What he raises.
Axe,	Chops, splits,	Wheat,
Plough,	Turns up soil,	Corn,
Harrow,	Makes soil fine,	Oats,
Hoe,	Plants,	Barley,
Spade,	Digs holes,	Rye,
Shovel,	Moves earth and grain,	Pease, Beans,
Crowbar,	Lifts stones, etc.,	Buckwheat,
Oxen,	Draw, cart, and plough,	Hay,
Scythe,	Cuts grass,	Potatoes,
Cradle,	Cuts grain,	Turnips,
Rake,	Collects grass and grain,	Pumpkins,
Pitchfork,	Lifts hay and grain,	Fruits,
Fanning-mill,	Cleans grain,	Sheep,
Bags,	Holds grain,	Cattle,
Baskets,	Carries fruit,	Hogs,
Ladder,	Climbs,	Hens, geese,
Horses,	Ride, plough, draw wagon,	Turkeys,
Wagon,	Carries loads,	Wool,
Chain.	Fastens.	Flax.

What does the farmer produce? How does he obtain his clothing and implements for work? Why does the farmer *plough, sow, plant, mow, thresh?*

The teacher should ask the several questions attached to each occupation, and talk with the pupils concerning them, that they may obtain correct ideas as to the importance of each kind of work.

CARPENTER.

Tools used for Cutting.—Axe, adze, chisels, gouges, shaving-knife, spoke-shave, hatchet, saw, broad-axe.

Tools used for Boring.—Augers, gimlets, bits-and-brace, brad-awl.

Tools used for Pounding. — Hammer, mallet, beetle, sledge-hammer.

Tools used for Measuring and Marking.—Rule, square, bevel, gauge, compasses, level, plumb-line, scratch-awl, chalk-line.

Tools used for Smoothing.—Planes, scraper, rasp, file, sand-paper.

Materials used.—*Timber* for sills, posts, beams, plates, rafters, girders, joists, braces, studs, scaffold. *Lumber:* plank, boards, siding, or clapboards, lath, shingles.

Parts of a Building.—Sides, ends, walls, partitions, roof, eaves, windows, doors, shutters, window-sill, door-sill, base, balcony, floors, ceiling, cornice, frieze, panel, moulding, stairs, etc.

Tools.	Their Uses.
Rule	For measuring.
Square	To form right angles.
Gauge	To make parallel lines.
Level	To find horizontal position.
Screw-driver	For driving screws.
Brad-awl	For making small holes.

Kinds of Work done.—Hewing, sawing, mortising, bevelling, mitering, scarfing, sheathing, siding, scribing, furring, framing, shingling, pinning.

What is meant by *hewing? sawing? mortising? bevelling? mitering? scarfing? sheathing? scribing? furring?* etc.

What do carpenters produce?

How do they procure food and clothing?

BLACKSMITH.

What he uses.	Why he uses it.
Forge	Place to work with iron.
Coal	To heat the iron.
Bellows......	To make the fire very hot.
Tongs.......	For holding hot iron.
Anvil........	To lay the hot iron on.
Hammer.....	For pounding the hot iron.
Punch.......	For making holes in hot iron.
Vise	For holding iron firmly while shaping or filing it.
Rasp........	Coarse file.
Drill	For boring holes in cold iron.
Chisel	For cutting iron.
Butteris......	A chisel-like instrument, with a bent shank and long handle, for paring hoofs of horses.
Bench.......	Table-like shelf at the side of the shop for small tools. The vise is fastened to it.

Kinds of Work Done.—Blowing, striking, welding, cutting, drilling, tempering, shoeing, setting tire, ironing wagons, etc.

Articles Made.—Horseshoes, nails, bolts, nuts, screws, braces, hammers, hooks, chains, hoes, axes, tires, etc.

Blacksmiths blow, heat, strike, weld, temper.
What do they *blow? heat? strike? weld? temper?*
Why do they *blow? heat? strike? weld? temper?*
What does the blacksmith *produce?*
How does he *procure food* and *clothing?*

TINSMITH.

Tools Used.—Shears, pincers, pliers, nippers, vise, hammer, mallet, soldering-furnace, soldering-iron.

Materials Used.—Tin, wire, sheet-iron, solder, rosin, charcoal, copper, brass, zinc.

Articles Made.—Pails, pans, cups, dippers, measures, teapots,

coffee-pots, teakettles, dishpans, saucepans, cans, boilers, coal-scuttles, tin roofs, etc.

Tin-ware is made from thin sheets of iron covered with tin by dipping the sheets of iron into melted tin three or four times. While the tin metal remains on the iron it protects the iron from rust. Tin metal is harder than lead, but softer than silver.

What does the tinsmith produce?

How does he obtain his food and clothing?

PAINTER.

What he uses.

For White Paint.—White-lead, zinc-white, Spanish-white.

For Yellow Paint.—Yellow-ochre, Naples-yellow, chrome-yellow, gamboge.

For Blue Paint.—Ultramarine, cobalt-blue, Antwerp-blue, Prussian-blue, indigo, Berlin-blue.

For Red Paint.—Red-lead, red-ochre, madder, cochineal, vermilion.

For Green Paint.—Chrome-green, emerald-green, Scheele's-green, verdigris.

For Brown Paint.—Umber, Terra di Sienna, bistre, Vandyke-brown, Spanish-brown.

For Black Paint.—Lamp-black, ivory-black.

For Mixing Paint.—Linseed-oil, spirits of turpentine. Sometimes the oil is boiled before mixing with paint; sometimes it is used in a raw state.

To make the paint dry quickly, a little litharge, or sugar of lead, or Japan varnish is mixed with it.

Implements and Materials Used.—Paint-stone, paint-mill for grinding paint, pots, cans, brushes, putty, putty-knife, pumice-stone, sand-paper, brushes, varnish, ladder, etc.

Kinds of Work Done.—Puttying holes over nail-heads, smoothing with sand-paper, "killing knots" with shellac, priming, paint-

ing, graining, marbling, stippling, sizing, varnishing, frescoing, kalsomining, lettering, oiling, etc.

The painter *preserves* and *ornaments.* He does not construct anything nor produce anything.

What has the painter to sell?

How does he obtain food and clothing?

PRINTER.

Materials and Instruments, and their Uses.

Type.—For printing letters, words, and figures.

Type-cases.—Shallow drawers, with small compartments or boxes for separating the different letters and figures.

Composing-stick.—A narrow, oblong frame, made of iron or steel, for holding type as the compositor sets the letters in words and sentences.

Galley.—An oblong, shallow tray, usually with a thin brass bottom, and sides of wood. When the compositor has set his stick full, he places the lines on the galley.

Imposing-stone.—A smooth stone slab, on which the type from the *galley* is placed, to be *made up* into pages and *forms*, ready for printing. When books are stereotyped, the pages are made up on a galley, then placed in a form and sent to the foundry, where a mould is taken of the face of the pages, and thin plates of type-metal are cast, from which the book is printed.

Chase.—An iron frame, which is placed around type on the *imposing-stone*, and into which the type or *matter* is firmly wedged with *furniture* (narrow strips of wood), and *quoins* or wedges.

Planer.—A smooth, oblong block of hard wood, which is placed upon the face of the type on the imposing-stone, and gently pounded, to make the surface even.

Shooting-stick.—The piece of wood or iron used in driving

the *quoins* or wedges when *locking up* the *form.* One end is placed against the wedge, and the other is struck with the mallet.

Leads.—Thin strips of type-metal placed between the lines of type to separate them, so that the print may be read more easily than when the lines are solid.

Printing-press.—The machine on which the *form* of type is placed, and by means of which paper is pressed upon the inked type and printed.

Platen.—The part of the printing-press on which the type rests.

Tympan.—Part of the printing-press; a wooden frame, covered with two folds of cloth, between which is stretched a woollen blanket. The *tympan* carries the sheet of paper to be printed, and forms a soft surface over the paper, to equalize the pressure upon the type.

Roller.—The part of the press that places the ink on the face of the type.

Frisket.—A slender frame to hold the sheet of paper in its proper place on the *tympan* while it is moved over the type to be printed.

Fly.—The frame of narrow, thin bars at the back of the press, which places the printed sheets upon each other in a pile.

Trough.—The box of water in which the pressman dampens the paper to prepare it for printing.

Kinds of Work done by the Printer.—*Composing*—setting type; *distributing*—placing the letters in their proper boxes, after they have been used; *justification*—increasing or diminishing the spaces uniformly between the words, until the lines agree with each other in length; *making-up*—adjusting the matter into pages after it has been set up by the compositor; *imposing*—placing the matter on the imposing-stone, after it has been made into pages, and enclosing it in a chase; *locking-up*—wedging the type firmly in the chase; *taking proof*—inking the type, and pressing upon it a sheet of damp paper; *reading proof*—having the manuscript, or copy from which the compositor

set his type, read, so as to compare it with the words in the proof-sheet; *correcting proof*—unlocking the matter, and changing all the words which were not set up correctly. This work is done by the compositor. *Revising the form*—comparing the type in the form with the proof, after the compositor has corrected his errors in setting, to see that all the corrections have been made. This is sometimes done by a *foreman*, the man who supervises the other workmen.

Terms used by Printers.— *Solid matter:* type set up without leads between the lines. *Leaded matter:* type that has leads placed between the lines. *Live matter:* type that has been set, but not yet used for printing that for which it was set. *Dead matter:* type that has been used in printing, and is ready to be distributed in the cases again. *Ems:* the square of the body of a letter *m* of each size of type is the measure for estimating the amount of matter that has been set of that size. The matter is measured to see how many square spaces of the *em* size the entire amount of type set up covers. Compositors are paid for setting type at a fixed sum for each thousand *ems*. *Proof-sheet*—the impression taken from the type after it is locked up.

Names of Sizes and Kinds of Type.

This is Great Primer type.

This line is English type.

This line is Pica type.

This line is Small Pica type.

This line is Long Primer type.

This line is Bourgeois type.

This line is Brevier type.

This line is Minion type.

This line is Nonpareil type.

This line is Agate type.

This line is Pearl type.

This line is Diamond type.

This line is Brilliant type.

This is Old English Type.

What is writing? What is printing? Why do people write? When do they write instead of print? Why is printing used instead of writing?

How does the printer obtain food and clothing?

Each trade, or occupation, may be made the subject of two or three lessons. These should be given at such times as will afford the pupils abundant opportunities, between the time of the first and the last lesson, to gain information by personal observation. The development and training that results from the experience of the pupils in seeking facts relating to a subject, *when the facts are sought from a desire to know*, rather than for a lesson to be recited, comprise the most valuable part of these lessons.

These and similar lessons may be multiplied by the teacher as the needs of the pupils and time will permit. It is not recommended that an attempt be made to give lessons upon all the trades and occupations that can be named, but rather that each teacher shall select a few—those most suitable for the particular class — and give these, from time to time, in alternation with lessons on animals, or some other subject, as a means of connecting home experiences and the daily observations of the pupils with school lessons, thus tending to make school instruction real education.

PHYSICAL TRAINING.

The great means of improving any power, physical or mental, is exercise. In all cases, the exercise is subject to the same laws and conditions, and produces the same results. The first effect of exercise on a muscle is to occasion the destruction of a portion of the material that composes it, and this leads to an increased flow of nutritious material to restore that part. In this way the repeated exercise of a muscle enlarges its size, and gives it increased strength and power.

In like manner, the exercise of any of our mental powers, while causing the destruction of a portion of the nerve material of the brain, causes also an additional flow of nutritious material to that part, and thus the mind is improved and strengthened by the increased volume and strength imparted to the organ of the mind—the brain.

The result of a proper exercise, whether physical or mental, is to increase the activity of all parts of the system. Thus, in a rapid walk the mental powers are affected, and ideas flow more readily. At first an increased flow of blood is imparted to all parts of the system; and it is when the waste in one particular part becomes greater than the natural supply can restore, that an additional supply is drawn from other parts, thus depriving those parts of their due share of nutrition, that a feeling of fatigue is produced. Any bodily exercise, long continued, tends to produce mental fatigue; and long-continued mental exercise occasions bodily fatigue. Hence

people who have much physical labor feel a dislike to great mental exercise, and those who perform great mental labor are naturally disinclined to engage in active physical exercise.

We may learn from a study of physical training how to proceed in the training of our mental powers, and also how to strengthen the moral powers. Leading children to observe and quietly practice what is right will have much better effect than the mere telling of the right and warning of the wrong.

The material upon which our mental manifestations depend is the same as that which supplies our physical frame, and is subject to the same laws, and is nourished in the same way. The same arterial blood nourishes all parts of the system, and is dependent upon the digestive, respiratory, and other functions of the body. Hence it is that *a sound body is necessary to a sound mind*, and soundness of mind is necessary to health of body.

There are more than five hundred muscles in the human body, and the great majority of these are under the control of the will power; yet from the want of proper training a double force is required to accomplish their work, because they are allowed to act in an irregular, slovenly, and awkward manner. By training the muscles to act promptly under the will power, the action itself becomes more easy, and the demand upon the nerve power is correspondingly less.

The effect of proper physical training is to enable the several bodily organs to perform the greatest amount of exercise with the greatest ease or the least fatigue. Physical education has for its true object the training of the various physical organs so that they will render a ready and efficient service to the mind.

"An important result of physical exercise is that it imparts health and vigor to all parts of the system. It

accelerates the circulation of the blood, strengthens the vessels, increases the cutaneous exhalations, and preserves the fluids in a healthy state. It improves the appetite, quickens the digestive operations, and increases the heat of the body. The body is thus rendered capable of resisting colds, and fortified against the attack of numerous diseases." Even in the cure of many diseases, physical exercise is an important agent.

Attention to physical training for developing and strengthening the body forms an important part in the requirements for a complete plan of education. Both the body and the mind may be educated by means of such exercises as will impart vigor and tone to their respective powers of action. Indeed, health of body increases the vigor of the mind; and the physical well-being of the body cannot be neglected without impairing the powers of mind. Foremost among the needs to secure a healthy body are pure air and an abundance of pleasure-giving exercise. And foremost among the important duties of parents, in relation to their children, is attention to the securing of the necessary conditions for the growth of healthy bodies; then the development of a sound mind may be made to follow by proper training.

Were suitable physical exercises made an essential and indispensable part of education for both sexes, many diseases which are the consequences of neglected bodily development, or the result of constitutional debility, might be prevented, and, at the same time, the mental faculties be more fully developed.

Were parents generally aware of the great extent to which the seeds of disease are sown in crowded school-rooms, and the common neglect by school officers and teachers of those matters which pertain to the physical welfare of children in school, they would not submit to such negligence in the adaptation of school-rooms to the

purposes for which they are used; for not only is the ventilation generally poor, but the means for proper exercise of the body are not provided.

It is true that in schools children do practise singing, marching, and various evolutions, such as clapping hands, folding arms, standing and sitting alternately, etc.; yet these exercises, although found to be of great utility, do not bring sufficiently into action the various parts of the body to answer the ends of more distinct physical exercises. Nevertheless they indicate, to some extent, the importance of proper attention to the physical education of children; also, that this matter would be better attended to by teachers were they provided with more specific directions as to how they may introduce suitable exercises into school without the expense and trouble of procuring apparatus.

It is hoped that the descriptions and illustrations of movements presented herewith, for exercising the different portions of the body, and the directions supplied for their use in school, will induce many teachers to give this matter more attention than they have hitherto devoted to it. And in the use of the following physical exercises it should be remembered that each kind of exercise has its appropriate conditions. It ought not to be continued too long, nor cease too soon; nor be made too slow, nor too fast.

PHYSICAL EXERCISES.

Kinds of Movements, and their Effects.—For convenience in describing the several kinds of movements, and for facility in directing the pupils while practising the different exercises embraced in each, the movements are divided into *seven classes*, the name of the class indicating the portion of the body which is to be exercised by it; and the class is divided into *groups*, to show the kinds of motions to be made. Several of the motions of each group are illustrated by cuts, to represent the mode of making them.

ARM MOVEMENTS.

First Group.—Arms-stretching.

Motions.—
- Arms forward—Fig. 1.
- " backward—Fig. 2.
- " upward—Fig. 3.
- " downward—Fig. 4.
- " sidewise—Fig. 5.

Arms Forward-stretching.—Move each arm forward and back, alternately, four times. Move both arms forward and back, with force, four times. See Fig. 1.

Arms Backward-stretching.—Move each arm backward, alternately, four times. Move both arms backward, with force, four times. See Fig. 2.

Arms Upward-stretching.—Move each arm upward, alternately, four times. Move both arms upward, with force, four times. See Fig. 3. As the arms are brought downward, the hands may strike the breast near the shoulder.

Arms Downward-stretching.—Move each arm downward, alternately, four times. Move both arms downward, with force, four times. See Fig. 4.

Arms Sidewise-stretching. — Move each arm sidewise, outward, alternately, four times. Move both arms outward, sidewise, four times, with force. See Fig. 5.


Fig. 1.


Fig. 2.


Fig. 3.

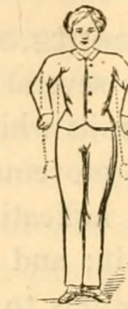
Fig. 4.

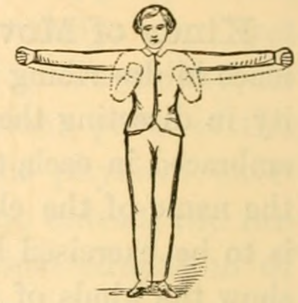
Fig. 5.

Arms-stretching Combined.—Move both arms *forward* twice, *backward* twice, *upward* twice, *downward* twice, *sidewise* twice.

Second Group.—Arms-swinging.

Motions.—
- Arms apart—Fig. 6.
- " together—Fig. 7.
- " sidewise—Fig. 8.
- " forward } Fig. 9.
- " backward } Fig. 9.

Arms Swinging Apart.—Place the arms together, horizontally, in front, and swing them apart, backward, four times. See Fig. 6.

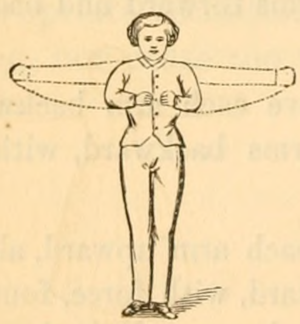
Fig. 6.

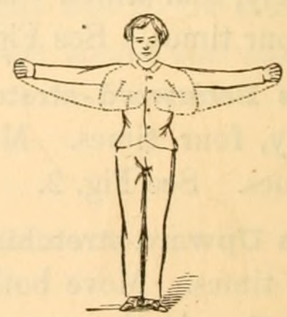
Fig. 7.

Arms Swinging Together.—Carry the arms, horizontally, from in front slowly outward, and bring them forward with force, striking the palms of the hands together. Repeat this four times. See Fig. 7.

Arms Swinging Sidewise.—Hold the arms parallel and horizontally, and swing them from side to side, four times, each way. See Fig. 8.

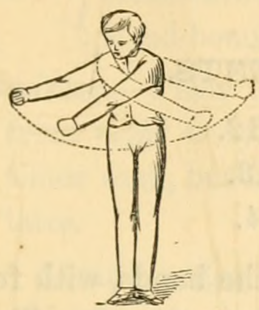
Fig. 8.

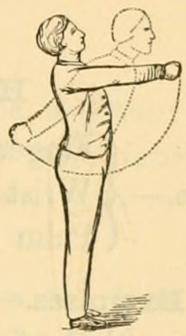
Fig. 9.

Arms Swinging Forward and Backward.—Place the arms in a horizontal position in front, then swing them backward and forward, four times each way, without bending the elbows. As the arms are swung backward, the shoulders should incline forward, as in the cut. See Fig. 9.

Third Group.—Arms-raising; Arms-twisting.

Arms Sidewise-raising.—Carry the arms, without bending them, from the sides slowly to a perpendicular position over the shoulders, and down again slowly, four times. This exercise greatly aids respiration. See Fig. 10.


Fig. 10.

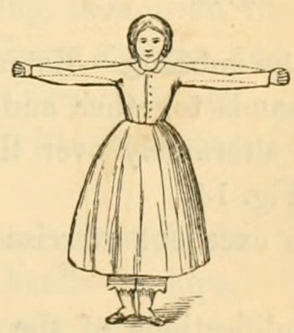
Fig. 11.

Arms-twisting.—Extend the arms horizontally, hold them straight, and twist them forward and backward four times each way. See Fig. 11.

The arm movements facilitate the circulation of the blood, give free action to the joints of the arms, promote expansion of the chest, and aid respiration.

HAND MOVEMENTS.

Motions.— Finger exercises—Fig. 12.
Wrist exercises—Fig. 13.
Palm exercises—Fig. 14.

Finger Exercises.—Open and shut the hands, with force, eight times. Spread the fingers as the hand opens. See Fig. 12.

Wrist Exercises.—Extend the arms in a horizontal position, keep them straight, and describe figure ∞ s with the hands closed, and with the hands open, four times in each position. See Fig. 13.

A good exercise for the wrists and muscles of the arms.

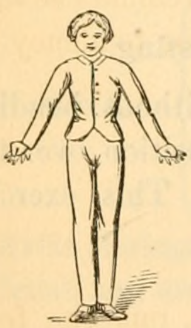

Fig. 12.

Fig. 13.

Fig. 14.

Palm-rubbing.—Extend the arms in front, press the palms of the hands together, and, without bending the elbows, draw each hand alternately over the entire length of the other four times. See Fig. 14.

An excellent exercise for the muscles of the arms and shoulders.

Modifications of the *arm movements* and of the *hand movements* may be introduced by the teacher that will add to the variety of the exercises and extend their good results. Care should be taken to keep up the interest of the pupils in all the movements.

HEAD MOVEMENTS.

Motions.—
- Head-rotating.
- Head-turning—Fig. 15.
- Head-bending—Fig. 16.

Head-rotating.—Place hands on the hips, and turn the head from *right to left*, and from *left to right*, four times each, bending the neck as the head rotates.

Fig. 15.

Fig. 16.

Head-turning.—Place hands on the hips, and turn the head sidewise, without bending the neck, four times each way. See Fig. 15.

Head-bending.—Place hands on hips, and bend the head *forward* and *backward*, four times each way. See Fig. 16.

The pupils should stand during these movements with heels together, and toes turned outward. The head movements should be made *slowly*. They are useful as a remedy for tendency to vertigo, giddiness, headache, etc.

KNEE MOVEMENTS.

Motions.—
- Knee forward-bending—Fig. 17.
- Courtesying—Fig. 18.

Knee Forward-bending.—Place hands on hips, put one foot a long step forward, as in pacing, then bend the forward knee, keeping the other knee straight, and thus lower and raise the body four times. Change position, and repeat the same with the other knee four times. See Fig. 17.

Fig. 17.

Fig. 18.

Courtesying, or Knee-bending.—Place heels together, toes turned outward, hands on hips, and let the body sink down slowly, as low as possible, while the trunk maintains an upright position; then rise on the tiptoes to the utmost height, four times each. See Fig. 18. These *knee movements* are excellent for the lower extremities, making the joints and muscles stronger.

SHOULDER MOVEMENTS.

Motions.— { Shoulder-raising—Fig. 19.
Shoulder-bending.


Fig. 19.

Shoulder-raising.—Raise right shoulder as high as possible four times, then left shoulder in same manner four times; then raise both shoulders together as high as possible four times. In making these motions, lower the shoulders gently, to prevent jarring of the head. See Fig. 19.

If any pupil has one shoulder lower than the other, the shoulder-raising should be performed with the defective shoulder *only*.

Shoulders Forward and Backward Bending.—Stand erect, place arms at sides, and bend shoulders forward and backward four times each way.

CHEST MOVEMENTS.

Motions.— { Chest expansion.
Half-chest exercise—Fig. 20.

Chest Expansion.—Place hands on hips, take full and deep inspirations, and allow the air to pass out slowly, through the nostrils, four times.

Second Exercise.—Inflate the lungs, and beat the chest, while holding the breath, four times with each hand alternately. Proceed gently at first.

Half-chest Exercise.—Place one hand under the arm, pressing tightly against the ribs, and put the other hand on the head; then bend the body sidewise as far as possible toward the hand against the side, and take four deep breaths.

Change the hands, and repeat the same with the other side four times. Let the breathing be as deep and complete as possible, but gentle and regular.


Fig. 20.

TRUNK MOVEMENTS.

First Group.—Trunk-twisting.

Motions.— Twist to the left—Fig. 21.
Twist to the right.
Twist left and right.

Make these motions with hands on hips, also with hands on head.


Fig. 21.

Trunk - twisting. — Stand with heels together, toes turned outward, and shoulders back; place hands on hips, and turn as far as possible without moving the feet, to the left two times, to the right two times, and to the left and right two times each way. See Fig. 21.

Repeat these motions with the hands on the head.

Second Group.—Trunk-bending.

Motions.— Bending sidewise—Fig. 22.
Forward and backward—Fig. 23.
Backward-bending—Fig. 24.

Trunk Sidewise - bending. — Stand with heels together, toes outward; place hands on hips, and bend the trunk two times to the right and two times to the left; then two times each way to the right and left. See Fig. 22.

The same motions may be repeated with hands clasped over the head.


Fig. 22.

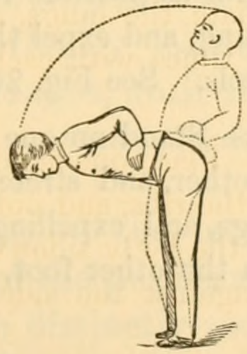
Fig. 23.


Fig. 24.

Trunk Forward and Backward Bending. — Stand as before, with hands on hips; keep the trunk straight while bending for-

ward and backward, as if the hips were the hinges, slowly four times. See Fig. 23.

Trunk Backward-bending.—Stand as before, place the hands firmly at the small of the back, and bend backward slowly, as far as possible, four times. See Fig. 24.

These trunk-bending movements tend to strengthen the muscles of the back and abdomen, and to relieve constipation.

Third Group.—Trunk-rotating.

Motions.— { Turn body toward right—Fig. 25.
Turn body toward left.

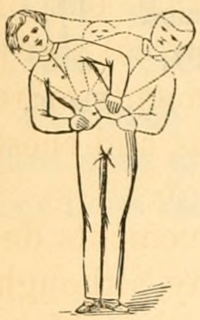
Fig. 25.

Trunk - rotating. — Stand with heels together, toes turned outward; place hands on hips, bend the body toward the right, round backward, left, and forward, slowly, four times; then bend body toward the left, round backward, right, and forward, four times. See Fig. 25.

Fourth Group.—Trunk-stretching.

Motions.— { Stretch on both feet—Fig. 26.
Stretch on one foot.

Trunk - stretching. — Stand with feet apart, extend the arms above the head, rise slowly upon the toes, and stretch upward as far as possible four times. Inflate the lungs while rising, and expel the air while settling down upon the heels. See Fig. 26.


Fig. 26.

Stretch on one Foot.—Stand on one foot, rest lightly on the toe of the other, and stretch upward four times, inflating the lungs, and expelling the air as before. Change; rest on the other foot, and stretch upward as before.

TEACHING THE MOVEMENTS.

In arranging the foregoing list of physical exercises, the aim has been to give a variety of motions which can be introduced into any school-room without apparatus, and, at the same time, such as will bring into action all parts of the body, but most thoroughly the trunk, arms, and upper portions of it. Owing to the fact that out of school children usually exercise their legs more than any other part of the body, in these school movements more exercise has been provided for the trunk, arms, and chest than for the legs.

It will be observed that several of the movements described act upon the same organs of the body, although in a somewhat different manner. All of these motions may be taught, yet during the daily drills the pupils should not go through with the entire list of exercises. Farther on, sets of movements will be given to indicate what would be appropriate for a single drill.

While teaching these exercises to the pupils, those of *one group of movements only* should be taught at the same lesson; but those previously learned may be reviewed with each new group taught, until the pupils are familiar with all the classes of movements, and with the exercises of each class.

In giving instruction in the movements, the teacher should stand in front of the pupils, at such a distance that all the motions can be distinctly seen, and the directions clearly understood. First, require every pupil to observe the teacher: this attention must be secured, or the exercises cannot be successfully introduced.

Care should be taken to secure prompt and uniform action by all the pupils, for this precision will add greatly to the interest of the exercises, and also to their beneficial effects upon the system. Indeed, promptness and decision alone will keep up interest in the movements for a long time, when all other means have failed.

After the pupils have become familiar with the exercises of several of the classes of movements, *sets of exercises* may be arranged for purpose of daily drill. In selecting the movements for these *sets*, care should be had to include those which act upon as wide a range of organs as practicable.

It is hoped that the following *sets* will sufficiently illustrate this point to enable teachers to arrange other *sets* of exercises with special reference to the needs of their own pupils.

SETS OF PHYSICAL EXERCISES.

I.

Arm Movements.—Arms-stretching.

Head Movements.—Head-turning.

Knee Movements.—Knee forward-bending.

Chest Movements.—Chest expansion.

Trunk Movements.—Trunk-twisting.

II.

Arm Movements.—Arms-swinging.

Hand Movements.—Finger exercises.

Head Movements.—Head-bending.

Knee Movements.—Courtesying.

Chest Movements.—Half-chest exercises.

Trunk Movements.—Trunk-bending.

III.

Arm Movements.—Arms-twisting, arms-raising.

Hand Movements.—Wrist exercises.

Head Movements.—Head-rotating.

Knee Movements.—Knee forward-bending.

Trunk Movements.—Trunk-stretching.

IV.

Arm Movements.—Arms-stretching.

Hand Movements.—Palm exercise.

Shoulder Movements.—Shoulder-raising.

Chest Movements.—Chest expansion.

Trunk Movements.—Trunk-rotating.

V.

Knee Movements.—Knee forward-bending.

Hand Movements.—Finger exercises, wrist exercises.

Shoulder Movements.—Shoulder-bending.

Trunk Movements.—Trunk-bending.

Chest Movements.—Half-chest exercise.

EXERCISE-DRILL.

HAVING described the movements, and given a few "sets" suitable for daily exercises, it now remains to point out a way in which these exercise-drills may be used in school for the promotion of good health, and improving the physical condition of the pupils.

These movements are best for a large class when accompanied with music by the piano; but, where this is not obtainable, vocal exercises may be substituted, such as counting one, two, three, four; or, making the vowel sounds, as $\overset{1}{a}$, $\overset{2}{a}$, $\overset{3}{a}$, $\overset{4}{a}$. Either a musical instrument or vocal exercises are important for securing that attention to time which gives precision and interest to the movements.

The teacher may direct the movements by announcing the *group* and *motions* somewhat as follows, viz.:

"**First Position**!" [Standing erect, resting upon both feet, heels together, toes turned outward about forty-five degrees, arms hanging at sides, eyes toward the teacher. This position is to be maintained until changed to execute the movement announced.]

"**Arms-stretching**: forward—one, two, three, four; backward—one, two, three, four; upward — one, two, three, four; downward — one, two, three, four; sidewise — one, two, three, four; rest." Pupils resume the first position.

"**Head-turning** [Pupils place hands on hips at this announcement]: right—one, two, three, four; left—one, two, three, four; rest."

"**Knee Forward-bending**: right — one, two, three, four; change; left—one, two, three, four; rest."

"**Chest expansion** [slowly, with lungs inflated]: one, two, three, four; inflate lungs—one, two, three, four; rest."

"**Trunk-twisting**: left—one, two, three, four; right—one, two, three, four; left and right—one, two, three, four; rest."

The announcement of the kind of movement should be the signal to the pupils that they are at once to assume the necessary position to commence the movement with the count one. Where a piano is used, signals may be arranged so that the pupils will be guided by the piano, after the kind of movement has been announced; indeed, a whole set of exercises could be conducted by signals on the piano alone. After a little careful experience the teacher will be able to devise modes of directing these *exercise-drills* in an appropriate manner. This experience will become successful by observing a few important facts, viz.: The exercise should be done slowly at first. A few thoroughly-mastered movements, well made, are more useful than many exercises half learned and poorly performed. Promptness in executing the movements, with a spirited, cheerful manner, add much to their usefulness.

During these exercises there should be an active cheerfulness; and, if amusement can be combined with them, their beneficial results will be more apparent. Some of the exercises require slow movements; others may be increased in rapidity, so as to be more enlivening, after the children have become accustomed to them.

It may be asked, How often should these physical exercises be given in school?

This question must be answered by one who is familiar with the arrangement of the school—the principal, or chief teacher. But in giving the answer it should be remembered that sufficient bodily exercise is just as important to the welfare of the child as is the mental exer-

cise, or study—indeed, the mental exercise cannot be most beneficial without due attention to the physical training.

With the younger pupils brief exercises should be had every half-hour, occupying the time of one group of movements. Sometimes the needed relief may be afforded the young pupils by standing and sitting two or three times alternately, and a brief exercise with hands and arms. In classes of older pupils the exercises may be used less frequently; but the teacher should notice those indications of the need of exercise, of fresh air, etc., which the pupils give by restlessness, listlessness, and general relaxation of interest and attention, and the necessary relief should be afforded at once, without waiting for a fixed time for physical exercises. This can usually be given by spending a few moments in some simple exercise that will promote a freer circulation of the blood.

But aside from these impromptu exercises, there should be at least fifteen minutes spent each half-day in such exercise-drills as will improve the general physical condition of the pupils.

Physical training should not be confined to the schoolroom. To train children properly, amusing games ought to be devised for play-ground exercises, and such as will cultivate kindly affections. Games of skill and dexterity should be encouraged, both at home and at school. Allowing children plenty of hearty, innocent fun on proper occasions will promote their happiness and increase their mental and physical development. Seek to guide children in suitable amusements rather than deprive them of such needed recreation. The confidence, love, and obedience of children may be won by such a course.

The primary school especially should be a light, cheerful place. The hours of school attendance should not be long; from four to five hours a day, for the younger

pupils of a primary school, is better than six, even for mental proficiency. A primary school that has even five hours of session per day should have an hour or more of interval at mid-day. Besides, there should be also one or two recesses during each session for the younger children. The exercises of the school should be so arranged as to give a change of position and of subject as often as every twenty or thirty minutes. Children will rarely give sufficient attention to derive much benefit from a lesson that is continued for a longer time.

Whenever possible, lessons that require the exercise of different senses should follow each other, with young pupils, as these changes afford relief to the mind, and continue the interest of the children in the lessons without fatigue.

Singing is a physical exercise of wonderful power in relieving the more serious work of the school. It exerts a calming and cheering influence. Singing is indispensable to the successful management of a primary school; it is a great moral power. Exercise songs, in which various physical actions are represented or performed by the pupils, are very appropriate for primary schools; but when an attempt is made to teach geography, arithmetic, or any other similar study by means of singing, an otherwise good exercise is employed for an improper purpose. The province of singing is not to train the intellectual powers, but to cultivate the feelings and the heart, and it should be used in its proper sphere.

The means suitable to be used for physical culture are various. A skilful teacher will select those best adapted for the peculiar circumstances of the school. All things that tend to cleanliness and personal neatness, proper modes of sitting, standing, walking, holding books, slates, sitting at desk and holding pen while writing, marching with a military step on leaving the school-room, are use-

ful means in physical training, and these matters should receive the careful attention of all teachers.

Training the voice by phonetics, or the elementary sounds of the language, in distinctness of articulation, in reading and speaking, is an important means of physical culture. In short, pure air, thorough ventilation, and regular physical exercise are indispensable to health of body and mental progress.

MORAL TRAINING* AND SCHOOL DISCIPLINE.

"O'er wayward childhood would'st thou hold firm rule,
And sun thee in the light of happy faces,
Love, Hope, and Patience, these must be thy graces,
And in thine own heart let them first keep school."

COLERIDGE.

If the intellectual powers of mind may be called the machinery of intelligence, the moral powers may be designated as the forces that set this machinery in motion, and direct the course of its action toward good or evil, happiness or misery. The right development of these forces, therefore, is of greater importance to the welfare of the child than the education of the intellectual powers.

Moral development is based upon the *emotions*. The emotions spring originally from those impulses which urge each individual to preserve his own life, to seek his own welfare, and which invite him through pleasures experienced to those things which are beneficial, and warn him by pains endured to shrink from that which is injurious. But emotions require the guidance of intelligence and reason to attain the best good for the individual and for society.

We cannot create an emotion, but we can incite it to action by presenting the appropriate stimulus. The law

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* Please read under head of *Science of Education* what is said about the "Powers of Moral Action," page 430; and the "Power of Willing," page 443.

of emotion is, "Like begets like." Kindness in us begets kindness in others; selfishness in ourselves awakens selfishness in those around us. The emotions become active, just as sensations arise in response to the natural excitants of their several organs. We can no more help loving that which seems to us amiable, and which awakens in us corresponding emotions, than we can help seeing light and hearing sound. The same may be said in regard to hating that which appears to us odious.

There are several kinds of impressions, which affect the emotions with differing results, as with *satisfaction*, with *pleasure*, with *disgust*, with *pain*. The two kinds of impressions which strengthen the mind are those of *satisfaction* and *pleasure;* those which weaken, or in some way affect the mind injuriously, are *disgust* and *pain*. These impressions are often produced by impatience, injustice, and constant fault-finding by those who have the training of children, and may result in great injury to their moral and intellectual life. Above all things, then, let such persons strive to be patient, gentle, and persevering in all their dealings with the young.

Emotions are the attractions and repulsions which tend to keep us in our proper relations to the world around. The emotions that we entertain return to us again and again, until they finally remain permanently, influencing all our conduct. Every action that we perform, every thought that crosses the mind, every emotion that we feel, is the beginning of what may become a habit, and a part of our character. No person is competent to say that he will do a wrong act only once, because the doing of that very act deprives him of a portion of his power to resist the temptation to do it again. So, on the other hand, each single, manly resistance of an inducement, or inclination, to do a wrong act increases the power of resistance, and weakens the temptation or desire to do it.

It has been well said that "a thought is an embryo action; give it time, and it will mature itself; entertain it, and it will return again and again, until at last nothing but a determined effort of the will can prevent it from acting itself out." Herein lies the real source of much of the wrong-doing in the world. Wrong thoughts are entertained until, unconsciously, they gain the power to escape in actions, and society is astounded by what seems to be a sudden loss of integrity. But the thoughts that led to the dishonest act had been entertained until its accumulated strength overcame the resistance of a weakened will.

To impress those under your instruction with habits of entertaining only good thoughts, and of acting from right motives, is your highest duty as a teacher. Success in this is the greatest triumph a teacher can attain. Training in good habits of thinking and acting is of more value to your pupils than the learning of all that the best text-books contain concerning the whole circle of the sciences.

How can these important ends in education be attained? What may Primary teachers do toward securing so great a boon for their pupils? These inquiries deserve more serious attention by each teacher than the matter of how to teach reading, spelling, arithmetic, geography, grammar, writing, or all of these studies combined.

Perhaps you are now in imagination before your class, and wishing to know how you can change the wayward actions of your pupils by moral training. How can the incidents of school be seized so as to drive out wrong actions by bringing in good actions? may be your inquiry. I shall not undertake to tell you how you may accomplish this result in each individual class, but I will try to bring before you incidents to explain the nature of this work, and such as I trust will give you practical

hints that will enable you to proceed so as to attain a good degree of success.

Whatever the means you select to aid in the moral training, in order to be effectual, must be so long continued as to gain power through the influence of habit.

Facts to be Remembered.—The following important facts should be remembered in connection with methods that may be employed in moral training and discipline:

First.—*From thirty to fifty active observers are receiving impressions from your manner of moving, from your tones of voice,* from the disposition and temper which you exhibit before them, from your kindness or the want of it, from your earnestness of purpose, from your justice and firmness, from your efforts to make the school-room pleasant. These impressions, according to their nature, will help or hinder your work of moral instruction and discipline.

Second.—*Cheerfulness of disposition, pleasant tones, words of encouragement,* kindly spoken and properly bestowed, evenness of manner, and uniform justness, will inspire the confidence of your pupils, and such a degree of respect as will remove the chief burden in governing your class.

Third. — *Study carefully the disposition, taste, and habits of your pupils.* Find out what most readily interests them, and what they like to do. *Awaken in them a desire to do something to please some one else,* and from this lead them to do things to please you. When you find that a boy can do one thing well, you have a key to his character, and an indication as to its proper management. What a boy does out of the pure impulse of his own nature, he does better than when he acts under any other motive.

Fourth.—*Remember that activity is a law of childhood.* Your success as a teacher will depend much upon the manner in which you *guide* that activity. Shape your methods of teaching so that your pupils shall have opportunity to be active in body as well

as in mind. They take the deepest interest in those exercises which afford activity for their limbs.

Remember that if you do not furnish occupation for your pupils, and make the lesson interesting to them, they will soon learn to find such occupation as pleases themselves, and become so eager in seeking it as to pay but little heed to your efforts for preventing them from acting in accordance with their bad choice.

The best order does not consist in maintaining any fixed position, nor in absolute quietness, but rather in that interested attention to the lessons which so occupies the minds of the pupils as to leave no inclination for disorder.

Fifth.—*To praise a child for meritorious conduct is as much the duty of a teacher as to reprove for faults.* Praise, whenever you can do so judiciously. Censure sparingly. Seldom find fault. Do not scold. *Never threaten.*

Believing that a boy has some good in him, and letting him know that you believe it, is one of the best means of putting it there. Such treatment will develop self-respect in children.

Sixth.—*Encourage your pupils by showing interest in their progress,* and by your kindness of manner. Let them feel sorrow at displeasing you, but not fear at seeing you. The following incidents will illustrate this point:

One day a poor boy, about eight years of age, was admitted into school. His chief characteristic appeared to be a stolid indifference to everything. He seldom smiled, scarcely ever laughed, and no other emotion changed his face. His teacher regarded him as a case of hopeless stupidity, yet did not tell the boy so. In the play-ground there was a circular swing. One day the teacher saw this boy take hold of a rope with one hand only, and swing himself around with body nearly as straight as an arrow. There must be nerve and will-power in that boy, thought the teacher, who praised his swinging, and noticed the first real ray of light in his eyes. From that day the teacher had hope for the boy, and the boy had regard for his teacher, and tried to do things to please him. He began to learn, and soon made such improvement that he seemed as one just awakening to a new life.

In another school a teacher noticed that one of her pupils, who had never taken much interest in her studies, and who made little progress in learning, could sing quite well. She asked the little girl to sing the exercise alone. She sung it well, and was commended for it. Then other pupils were asked to try to sing it as well as Jane did. Afterward Jane was called to sing other exercises alone, and made rapid improvement in singing.

Her teacher after a few weeks noticed that Jane was also taking more interest in her other lessons; that she was making much improvement; and commended her for it. One day, after commending Jane for advancement in her studies, the teacher asked what made her take so much more interest in her lessons than she formerly did. Her answer, "I feel more encouraged than I did," points to *encouragement* as one of the means of success in your work as a teacher.

Seventh.—*Treat your pupils with kindness in the correction of their faults*, and thus gain their confidence and respect. Let them feel that you sympathize with them in those unfortunate deeds which result from accidents, without any wrong intention. The case of the boy who broke a pane of glass accidentally will suggest a temper of mind for dealing with similar incidents.

During the recess one day, a little boy threw a piece of coal, without thinking of the window toward which he sent it. It struck a pane of glass and broke it. The teacher chanced to see the act. When the boys returned to their seats, the teacher concluded to wait awhile before alluding to the accident. The exercises were resumed as usual. After a while the boy who threw the piece of coal was requested, very kindly, to show the teacher his example in arithmetic. He felt the kindness of the teacher while standing by her, and took courage to say, in a quiet tone of voice, "A boy broke a window." The teacher took him gently by the hand, and he added, "He broke it with a piece of coal; but he did not mean to do it." The teacher said, "I am very sorry," but showed no signs of harshness; and the boy took courage to say, "I broke it; I am very sorry." The teacher kissed the little boy, and commended him for telling her about it, then added words of admonition.

That incident proved more effectual in guarding that boy against similar carelessness, and was more lasting in its influence toward right actions, than would have been sharp reproof before the class, or any infliction of corporal punishment.

Eighth.—*Do not attempt to govern your class by naming individual pupils, and charging them with faults.* Such a course seldom secures the desired end. Scolding for every petty offence does not make pupils more careful to comply with your wishes, or to obey your commands. Remember that your pupils do not love continual fault-finding, or scolding, more than you did when you were a pupil. Try to imagine yourself the pupil, and to think what course would be most likely to secure your own attention and cheerful obedience under similar circumstances, and let your decision guide in the treatment of your pupils.

Ninth.—*Develop a right public opinion in your school.* Instead of giving your attention to individual pupils and single misdeeds, trying to correct each in detail, endeavor to deal with faults in such a manner as to exert an influence upon the entire class which will lead to right thoughts and better actions. Aim thus to *develop the public opinion of your class in favor of the right*, so that you may govern individual pupils through the influence of your class.

Suppose you have a class of young pupils, among whom are many careless or restless children, and you notice that they make a great deal of noise in taking slates from the desks, or in placing slates on the desks;—to tell them to make less noise, or to remind John, Charles, and William that they are too noisy, or to take their slates away from them, will not secure habits of handling slates quietly. But if you tell the class that some of the boys are always quiet in handling their slates, and that it would be *so* pleasant if all the boys would try to be quiet, then ask, how many would like to try to put down and take up their slates quietly? The unanimous response would commit the class in favor of less noise. Then, by dividing your class into three or more sections, by their seats, and asking one section to take slates, and put away slates, while the others observe how quietly it is

done, you would direct attention to the matter, so as to make it easy to induce each section to try to excel the others in handling slates quietly. Commend the section that does best, and encourage each other section to excel it.

By such or a similar plan of directing the attention of the class favorably to that which you desire to secure, and by appealing to the self-respect and satisfaction which accompany success through praiseworthy efforts, good habits may be formed that will relieve the teacher of very many annoyances that usually arise in discipline. And if such plans be wisely carried out in all matters of discipline, the moral training produced thereby will ultimately place the teacher in the position of director, or leader, in matters of school government, and the pupils as his willing allies. The exceptional cases that need special attention will be few and easily managed.

Tenth. — *Do not repeatedly tell pupils of their own faults.* Instead of directly telling pupils of their faults and bad conduct, lead them to see their own misdeeds in their true light, through the public opinion of the class. The following incidents will illustrate this point:

One morning in summer a little boy went to his teacher, and said, in substance, "Henry and I found a bird's-nest yesterday, on our way home from school; it had little birds in it. Henry took away the nest, and left the young birds on the ground." The teacher expressed sorrow at the cruel act, and told the boy to go to his seat.

The teacher began to think what could be done with this incident to benefit the school and correct Henry's cruel disposition. Henry was a boy in whom kindness had never been developed by his home treatment. Domestic bliss did not abide with his parents. Henry was accustomed to the whip for every trivial offence as regularly as to his meals and sleep. One evening, after being put to bed, he was heard to tell his mother, in response to her repeated command to "go to sleep," "I can't go to sleep; you have not whipped me yet."

Henry attended school quite regularly, but made very little

progress in anything except mischief. On the occasion of his cruelty to the young birds, the teacher decided to use this act so as to awaken in all the younger pupils feelings of kindness toward birds. Accordingly, when a class composed of children but little older than Henry, yet much farther advanced in their reading, was called to read, the teacher selected a lesson about boys robbing a bird's-nest. Without intimating why this lesson was chosen, Henry was requested to stand by the teacher, and listen to what the class read. He did not know that the teacher had heard of his cruel act toward the young birds.

Henry listened to the story of robbing a bird's-nest with an interest unusual to him, and it soon became evident that the reading lesson was a moral mirror, in which he saw himself reflected; for, before the lesson was finished, he looked up to his teacher, and said, "I did not kill the birds." His teacher asked, "Did you find a bird's-nest?" "Yes, but I did not *kill* the little birds," said Henry; "I only threw the nest away, and left the birds on the ground."

In reply to a few questions, Henry told the story about the finding of the bird's-nest, and his treatment of it the night before, substantially as the little boy had told the teacher that morning. Then, without directly reproving Henry for what he did, an appeal was made to the class to decide whether the conduct of the boys, as described in the lesson read, was right or not; then the class was asked if it would be right for one of them to do as the boy in the lesson did; then, if it was cruel to throw away the nest of young birds, and leave the little ones on the cold ground. While the public opinion of the class was so strong for the right, supposed cases were presented for the opinion of the class as to what would be right, and all the probable cases were decided in favor of kindness to birds, and against cruelty.

This single lesson proved effective; neither Henry nor any other boy in school was known to treat birds with cruelty during the remainder of that term; and doubtless the feelings of kindness toward birds, which were awakened by that incident, exerted an influence that extended through many years. This incident occurred more than thirty years ago, yet that teacher remembers

to-day the intense and earnest feeling manifested by that class; and such scenes do not easily fade from childhood memory. Similar methods may be used to correct some of the bad habits in your class.

Some of the cases of bad conduct in school can be dealt with effectively only by moral means, and these can usually be employed best through the public opinion of the class. Instances of disrespectfulness toward a teacher, or toward other persons, belong to this class of cases.

One day a boy gave the principal of his school an insolent reply. All who heard it were greatly astonished; but the principal did not exhibit anger by scolding, or threatening the boy with punishment. He quickly determined to improve that opportunity by teaching a valuable lesson to the entire school. The very calmness of his manner made a deep impression on the school; and, while the pupils wondered how the disrespectful boy would be punished, they felt certain that such conduct would not be allowed to pass unnoticed.

The hour for closing came, and school was dismissed without any allusion to the conduct of the boy. That night the principal made his plans, to be carried out on the following day. After the customary opening exercises on the morning of the next day, the principal addressed the school substantially as follows:

"Boys, if, while you were at play in the street before school opened, a gentleman who was passing the school should inquire the direction to the railroad station, would you tell him the way in a respectful manner?"

"Yes, sir," was the unanimous response.

"Suppose a common laborer, whose occupation soiled his garments, should come along, and ask the way to —— Street, would you tell him as well as you could, or would you treat him rudely, telling him to go about his business?"

"We would tell him the right way," said the boys.

"Very good," said the principal; "I am pleased to know that you have too much respect for yourselves and for others to behave rudely under such circumstances. Now, suppose a man, very poorly clad, who was seeking work that he might earn food

for his wife and children, or even one who was begging his daily food, should ask you a civil question, how would you treat him? Would you give him a civil answer?"

"Yes, sir," responded the school.

"That is right, boys; I am happy to know that you believe it to be right to treat all persons civilly, and to answer all proper questions respectfully, without regard to the external appearance of the one who asks the question."

Thus the principal prepared the school for the lesson he had planned to give. After a pause, looking carefully over the school, until all eyes were fixed upon him, even those of the boy who gave him a disrespectful answer the day before, he said, in a deliberate manner, with a kind but sad tone of voice, "Yesterday afternoon I asked a question of one of the boys of this school. It was a proper question for me to ask a pupil; it was a question which was justly entitled to a respectful reply; and yet I am very sorry to know that even one boy in this school so far forgot that respect which is due to his parents, which is due to his teacher, and due to his school-mates, as to give his principal a less civil reply than should have been given to a beggar in the street. I hope no boy in this school will ever again forget, under any circumstances, to be respectful."

No amount of personal reproof administered to the guilty boy could have produced such beneficial results upon him as did that lesson, which also elevated the moral tone of the entire school.

Eleventh.—*Punishments should be adapted to offences.* If a boy persists in annoying his companions during recesses, do not allow him to take a recess with the other boys; if he abuses any liberty allowed him, deprive him of that liberty until he learns to prize it as he ought. *Never assign a lesson as a punishment for anything except neglect to learn the lesson.* Ordinary school work should not be prescribed as a punishment for the common offences of school. School lessons should have pleasant associations. To punish all offences in the same way will confound the sense of justice in children. Timid pupils require tender treatment.

Twelfth.—*Do not tempt your pupils to tell a falsehood.* Much tact should be used by the teacher in discovering which pupils are guilty of wrong conduct. Do not question children in such a manner as to tempt them to tell a falsehood through fear of punishment. If you are uncertain who is in fault, do not directly accuse any one personally. Don't say, "John, I believe you did that," unless you know that he did. If you feel it your duty to make a personal accusation against a pupil, let it be done privately with that pupil.

Many young children possess very indefinite ideas of truth and falsehood. Fear often leads such children to say that which they know to be false. Endeavor to overcome this tendency to tell a lie by treating all confessions of wrong with gentleness and kindness, as in the case of the boy who broke the pane of glass, and confessed it to his teacher. Remove all temptations to falsehood. *Lead not your pupils into temptation, but seek to deliver them from their evil tendencies.*

Govern your school without making the government so prominent that it is burdensome to good children. Make your government light by teaching the pupils to govern themselves.

Thirteenth.—*Develop the feeling of self-respect in your pupils.* To do this most effectively, treat them with respect at all times. Let them feel that their good conduct is respected by you, and that they can make themselves worthy of respect from all who know them.

If a boy be suspected, if his feelings, tastes, and acts are treated with contempt or ridicule, he will lose respect for you, for others, and for himself. A boy who is continually told that he is *bad* will come to believe it, and act accordingly.

When praising a child, do it for his good actions and right motives. Praise honest efforts, not mere ability. Praise every child who strives diligently to make good use of his abilities. Take care that you do not develop a love of approbation into a love of mere flattery by giving praise when it is not deserved.

Censure should be just, and free from bitterness. Avoid ridicule. Conceit and vanity may sometimes need to be lowered

by good-humored ridicule; but this is a dangerous remedy, and should be seldom employed.

Fourteenth.—*Lead pupils to overcome idleness by pointing to its evils.* Check idleness by appropriate privations that result from it. Let children understand that idle habits clothe men and women in rags.

Fifteenth.—*Mischief may be checked by causing pupils to feel its effects upon themselves.* When injury to property is the result of mischief, require complete restoration by the doer of the mischief.

There are many difficulties which the teacher will meet in the management of his pupils. One of the most troublesome to remove is that of *sulkiness.* One mode of overcoming this unfortunate habit is to allow the pupil's sullenness to subside by tiring him of his own unhappiness. By awakening bright and cheerful thoughts in the minds of your pupils, harmony of the feelings may be restored, and sulkiness overcome. Lead the reason of the pupils to gain control of their feelings, and thus influence the will to direct them in the right way. In attempting to do this, you must *make haste slowly.*

Love of knowledge—that natural desire of the child to know something about everything that he sees—is one of the means of good discipline, and the teacher should aim to present instruction so as to gratify this desire.

Ascertaining what motives may be properly used for securing attention, and leading children to right conduct, constitutes an important part of good school discipline.

The example of the teacher has a most powerful influence on the discipline of the school. The tones of voice, the language used, the manner of treating the pupils, the disposition, orderly habits, and neatness—all exert a powerful influence upon pupils. Children try to imitate justice, kindness, truthfulness, dignity, neatness, and refinement, as they see it in the daily acts of their teacher.

The little girl who said, "Mother, I try to love my teacher, but she is so cross, and scolds so much, I cannot love her," is

a sad criticism on too many who fail to find pleasure in their work.

"I love to go to school now; my new teacher is so kind to us; I mean to do all I can to please her," is a commendation that all teachers should try to deserve from the children under their care. "*Love, Hope, and Patience*" will enable you to enjoy the sunlight of happy faces.

"The main object of moral training is to give a right direction to the action of the moral powers, to encourage virtuous inclinations, sentiments, and passions, and to repress those that are evil. It is to cultivate habits of truthfulness, obedience, industry, temperance, prudence, and respect for the rights of others, with a view to the formation of good character.

"The great object in moral training, like that of physical and intellectual education, is to develop force, with a view to the pupil's *self-action.* Unless this point is gained, little is gained. The pupil's character is not to be one merely for holiday show, but for the daily duties of life; a character which will not be the sport of every wind of doctrine, but one in which virtue—moral strength—is firmly embodied. Such a character can only be formed by making the child himself a co-operator in the process of its formation."*

* *Lecture on the Theory or Science of Education*, by Joseph Payne.

SCIENCE OF COMMON THINGS.

Attention to common things, and to the principles employed in the construction and operations of playthings for children, is a most valuable means for leading them to form habits of intelligent observation, and cultivate their common-sense. The knowledge acquired by making observations and experiments upon common things is the beginning of the development of common-sense, and of scientific knowledge. Science is common-sense perfected.

When a child observes the nature of a new toy, and makes experiments to see what can be done with it, his method of procedure is the same in character as that by which great results in science are obtained. The way to science is through a knowledge of common things.

The purpose of introducing the subject of common things distinct from those relating specially to animals, plants, minerals, etc., is that thereby the attention of teachers may be directed to a source of very valuable materials which are admirably adapted for the training of children to gain scientific knowledge, and to understand facts and laws in nature that belong to the department of science known as physics, or natural philosophy. Toward the accomplishment of this purpose, the following suggestive hints are given.

The atmosphere is the air surrounding the earth. We breathe it, and move about in it, but cannot see it; *it is invisible and transparent; it has weight; it presses in*

all directions, upward as well as downward; *it is compressible and elastic; it expands by heat, and contracts by cold; it acquires force by heat, and also by compression; it conveys sound; things lighter than air will rise upward in it*, as a cork rises upward through water, after being forced beneath it.

These facts can be readily illustrated by simple experiments with familiar things, as may be seen from the following suggestions:

Air is Invisible and Transparent.—These facts will be understood by reminding the pupils that they *see through air, but cannot see it.*

Air has Weight.—The atmosphere is attracted by the earth with sufficient power to cause it to have weight equal to *fifteen pounds on each square inch.* This weight is observed by the force of its pressure on a surface.

The Boy's Sucker.—The pressure may be illustrated by the boy's sucker, which is made of a circular piece of sole-leather, with a string fastened to its centre. When this piece of leather is moistened and pressed upon a smooth stone, so as to force all the air from between the leather and the stone, and the string is pulled, a vacuum is formed under the centre of the leather, but the pressure of the atmosphere causes the surrounding portions of the leather to adhere to the stone with considerable force.

How Flies Walk on the Ceiling.—The feet of flies have a contrivance which acts somewhat like the boy's sucker; and this enables them to walk on the ceiling.

How the Pump Raises Water.—It is owing to the fact that the atmosphere presses water into the space from which air has been exhausted that the common pump raises water from the well. As the air is drawn from the tube by the valves attached to the piston-rod, the water flows up to fill the place.

The Syphon.—The pressure of the atmosphere causes a fluid to flow through a syphon, while the end of the long branch of the syphon is lower than the end of the short branch.

The upward pressure of the atmosphere may be illustrated by filling a small tumbler with water, covering the top with a card, placing the hand on the card and turning the whole upside down, then removing the hand gently. The card will remain firmly pressed against the tumbler by the atmosphere, and keep the water from flowing out.

The external pressure of the atmosphere prevents a liquid from running out of a barrel which has no vent-hole, or place for the air to enter above the liquid. Sometimes tea will not pour out of the teapot because the air cannot enter above the tea. Water will remain in a straw or long tube when the upper end is closed, because of the atmospheric pressure from below.

The boy's pop-gun will illustrate that air is compressible and elastic. When the cork or wad is pushed in by the piston the air within is compressed into a smaller space, until the force which the air accumulates by the pressure becomes so great that it drives out the cork or wad at the opposite end with a popping noise. The noise is produced by the sudden expansion of the air as it leaves the tube.

Other illustrations of the compressibility of air, and its power of resistance, may be made as follows: Invert an empty tumbler or a glass jar, placing its mouth on the surface of water, then let a pupil press down upon the jar, and try to force it into the water so that the water shall fill it, and observe that the water rises a little higher in the glass as the pressure upon it is increased, and that the water inside the glass cannot be made to rise as high as the water on the outside. This is owing to

the presence of the air in the glass, which cannot be compressed so as to allow the water to fill the glass.

The toy-balloon, or a bladder nearly filled with air, when exposed to heat, will illustrate the expansion of air, and the force produced by the expansion. By removing the heated toy-balloon or bladder to a cold place, it will be observed that the air contracts by cold. If a bladder be blown full of air, then exposed to heat for a short time, the force produced by the expansion of the air within it will cause the bladder to explode with a loud report.

Air Conveys Sound.—Where there is no air sound is not heard. Sound is produced by the vibrations of substances. It moves through the air at the rate of about 1100 feet in a second. It moves through water about *four times as fast* as through the air, and through a wall about *three and one-half times as fast;* through gold about *five times as fast;* through silver about *seven and three-fourth times as fast;* through copper about *nine and two-third times as fast;* through wood, lengthwise, about *ten times as fast;* through iron about *fifteen times as fast* as through the air.

Light moves about 190,000 miles while sound moves 1100 feet, so that practically from any object on the earth, within the range of vision, light would pass to our eyes instantly. The following incidents will aid in illustrating that sound moves much slower than light:

Flash and Report of a Gun.—When a gun is fired at a distance from the observer, the flash will be seen several seconds before the report is heard. When the steam-whistle of a distant locomotive is blown, the steam will be seen issuing from the whistle some seconds before the sound is heard by the distant observer.

Lightning and Thunder.—By observing the number of seconds that intervene between the flash of lightning and

the thunder—which may be ascertained by counting slowly—the distance of the thunder-cloud may be estimated by reckoning one-fifth of a mile for each second of time. While four or five seconds of time intervene between the lightning and the thunder, the cloud is too far away to produce any harm in the vicinity of the observer.

Sound Conveyed by Solids.—If you place your ear at the end of a long timber, while some one scratches with a pin the other end, you can hear the scratching distinctly. If you place your ear against a long solid wall of brick, at one end of it, and let some one strike the other end of the wall, you will hear two reports, the first one through the wall, and a second one through the air. The earth also conveys sound. Indians understand this, and by placing their ears on the ground ascertain the approach of an enemy, or of a herd of buffaloes.

These sounds are conveyed by the vibratory motions of the particles of the solids; yet the solid as a whole does not move. The vibrations of the particles take place within such minute spaces that their movements are not perceptible as motion.

A Poker and a Boiling Kettle.—If you wish to ascertain whether or not a teakettle is boiling, place one end of an iron poker on the lid, and the other end to your ear, and if the water in the teakettle be boiling, the kind of sound conducted by this iron rod will inform you.

An echo is sound reflected. Sometimes the same sound is reflected two or three times, and thus produces two or three separate echoes.

Vapor arising from wet clothing is cool; for this reason pupils should not be required to sit in wet clothing at school, but should be allowed to move about while the clothing is drying.

The direction of a gentle wind may be ascertained by

wetting one side of the hand, holding it up and turning it slowly until the wet side feels cool. The moisture evaporates faster on the side of the wind, and causes that side to feel cooler.

A wet towel wrapped around an ice-pitcher, or a bottle containing any fluid, will keep it cooler than a dry towel, because evaporation keeps the wet towel cool.

Water Contracts and Expands.—When hot water cools it contracts until it reaches a temperature of about 39°. As it grows colder from this point it expands. At 32° it freezes, and in the solid state it expands much more rapidly, and with such force as to burst the pipe or vessel that contains it.

Heat and Cold change the Volume, but not the Weight.—Water changes in volume by heat and by cold, but does not change in weight by heat or by cold. A cubic inch of water weighs about 252 grains. When this amount of water is changed into steam, its volume is 1700 cubic inches, but its weight remains as before, 252 grains. When the cubic inch of water is changed into ice, its volume is one and one-eleventh cubic inches, but its weight remains as before, 252 grains. It appears, therefore, that neither the heat nor the cold which produce these changes can possess weight.

Heat is caused by the vibratory movements of the particles of matter. Each vibration is very rapid, backward and forward, within a very short space. These vibrations are so minute that they are scarcely perceptible as motion. The boy knows by experience that a metal button can be made hot by rubbing it on any substance; that two sticks can be made hot by rubbing them against each other briskly. He may learn by experience that two pieces of ice can be melted by the heat produced by rubbing them together.

Air in Water.—The presence of air in water may be

noticed by leaving water in a glass or pitcher until it becomes warm, when numerous small bubbles appear around the sides, as the warmth expands the air.

The rapid expansion of the air by heat, and its rising in bubbles to the surface, produces boiling.

Salt-water requires more Heat to cause it to Boil than Fresh-water.—For this reason a little salt put into water used for cooking potatoes will make them cook sooner, after the water boils, because of the greater degree of heat required to cause salt-water to boil.

Water Communicates Pressure in all Directions.—A small column of water, thirty feet in height, will press with great force upon a *confined* body of water at the bottom of the column. If the pressure of the small column be equal to 1000 pounds, and the body of water at the base be ten times the size of that in the column, the pressure on the confined body of water at the base will be 10,000 pounds in each direction. The pressure of a body of level water is only downward and sidewise.

Specific Gravity.—If a substance be of the same weight as water, bulk for bulk, it will neither sink nor swim, but move about in the water as if it had no weight. If a body weighs *ten ounces* in the air, and only *nine ounces* in water, it is found that the bulk of water equal in size to the body weighs only one ounce, and that the body is *ten times as heavy* as water; therefore, *its specific gravity is said to be ten.* If any body is just twice as heavy as the same bulk of water, it has a specific gravity of two.

The Mechanical Powers.—The *lever* and its uses may be illustrated with a ruler, or even a pen-holder. The *wedge* may be illustrated by the blade of a knife, or by a piece of wood cut into the shape of the wedge. *An inclined plane* may be illustrated by the use of a slate, or a book, or a piece of board; *a pulley*, by ribbon-blocks;

the wheel and axle, by spools; *the screw*, by a part of an auger or of a wooden screw.

The simpler the objects for the illustrations, the greater will be the probability that the pupils will try to make experiments to illustrate the same fact at home, and thus gain a practical knowledge of the lesson.

A pair of stilts; a seesaw; the balancing of a pole on one end, in the hand; the balancing of a ruler across the finger; the suspension of a common card by a string—each furnish practical illustrations of the importance of giving attention to the centre of gravity.

Let these lessons relating to the Science of Common Things be conducted in a manner that will require the pupils to take part in the experiments and illustrations, and let the character be such that the pupils can make the same experiments at home, and the instruction will be thorough and practical.

The minds of children are hungry for this sort of knowledge; and the teacher who fails to point out the way to it, and neglects to supply the opportunity for gratifying it, leaves undone a most important part of his work.

Facts relating to philosophy and science should be presented to children first through experiments. When the range of possibilities in school-room work has been reached in this direction, other important facts, to supply further knowledge of the subject as a whole, may be taught empirically, especially where the pupil's lack of knowledge in other kindred departments of science prevents his knowing these important and needed facts through other means.

N. B.—For further information relative to the Science of Common Things, the teacher is referred to *Hooker's Natural Philosophy*, published by Harper & Brothers; also to the *Science Primers*—"Introductory" and "Physics"—published by D. Appleton & Co.

SCIENCE OF EDUCATION.

SCIENCE OF EDUCATION.

INTRODUCTION.

The laws of human development—the order in which the faculties of children unfold, the subjects and processes most suitable to educe mental activity and development, and the modes by which the mind gains knowledge—are among the most important things to be regarded in the building up of a *Science of Education*. By means of a knowledge of such a science, the methods for education will not be left to mere chance as to their fitness, and the teacher need not grope in the dark to find his true work. On this science the *art of teaching* may be founded, with a series of training exercises for the proper development of the human faculties in the several stages of progress from infancy to maturity, the use of which will render success in the work of education certain.

Successful culture of the mind requires a thorough knowledge of its powers, of their tendencies, and of the manner in which these are affected by external agencies. To attain this knowledge, we must observe the manner of the child's development by the aid of the sciences of physiology and psychology; but our chief investigations must be made through psychology.

Methods of education can be true only so far as they harmonize with the modes and conditions under which the mind attains knowledge. Accuracy in observing the modes and conditions of mental development, and skill in selecting and using the appropriate means of education, are essential to the complete success of a teacher. But

the attainment of such accuracy and skill requires a long period of time, and many years of observation and experiment on the part of each teacher, when left to acquire them without aid from the experience of others; and during this time a multitude of mistakes may be made, each of which, sad as it might be for the teacher, would be of far greater injury to the pupils; hence it becomes a matter of the greatest importance that steps be taken toward guiding the inexperienced teacher in the way to successful instruction, and teaching him how to determine whether a method be a true or a false one—whether it will produce the desired result in education, or lead the learner to final disappointment.

To aid the teacher in determining the true character of the work to be performed, and to point out the way to success in the art of teaching, is my aim in presenting that which follows, under the title of the *Science of Education*. For the attainment of this purpose I have availed myself of materials from various sources of acknowledged authority, and woven these into such form as seemed best fitted to accomplish the end in view.

In attempting to set forth such principles as underlie all true educational processes, it will be necessary first to describe some of the powers of the human mind, and to explain terms used in speaking of the various modes of mental activity. In endeavoring to do this, I shall not attempt to present a treatise on mental philosophy, nor to explain all the activities of the mind, but shall try rather to describe the most important forms of mental action, and the modes and means by which these develop the powers of mind, so *that teachers may obtain clearer ideas—Of the work in which they are engaged;*

Of the nature of the materials with which they deal;

Of the means and modes by which their aims may be more completely attained.

DEFINITIONS OF EDUCATIONAL TERMS.

Before proceeding to consider the powers of the mind, I will define some of the terms commonly used in relation to education, and thus endeavor to make them less vague and uncertain in meaning and use. I will also add the most important *principles of education*, and give a few suggestions concerning their application to methods of teaching.

Education comprehends all the influences which operate on the human being, stimulating his faculties to action, forming his habits, moulding his character, and making him what he is.*

Whatever helps to shape the human being, to make the individual what he is, or hinder him from being what he is not, is part of his education.†

The general object of education is to form the man, not the lawyer—the man, not the physician—the man, not the merchant, nor the mechanic, but the *true* man, including that which is noblest and best in him.

The Science of Education consists in a knowledge of those principles of psychology which account for the processes by which the mind gains knowledge. Its foundation extends down to the laws of our being and growth. It embraces the principles of physical, mental, and moral actions, and all suitable means for the proper development of the human being. *It is a standard by which methods of education may be tested.* Science tells us what a thing

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* Joseph Payne. † J. S. Mill.

is, and why it is what it is. It treats of the nature of the thing, of its relations to other things, and of the laws of its being.

Pedagogy, or Pedagogics, are names frequently applied to the science of education.

A Principle of Education is a general truth gained by an analytical investigation into the nature of the child as a thinking being. It is a law of the mind, and a rule of its action.

The following established fact, or law, constitutes one of the important principles of education: *Proper exercise of any bodily organ, or any power of the mind, increases its strength.*

Teaching is one of the most important means for carrying forward the work of education. It implies the proper guidance of the learner to the sources of knowledge, and training him in getting and properly using that knowledge.

Training, in education, implies exercises of the powers of mind in connection with things observed and facts taught. Its purpose is to give such facility and habits of action as will increase quickness in perceiving, readiness in remembering, accuracy in reasoning, and skill in doing.

The Art of Teaching is the application of the laws of the science of education. It implies skill in teaching each subject by the use of proper methods, and in accordance with the principles of education. It is founded on the science of education, and the science of education is founded on the science of the mind. Art in teaching takes the laws which are established in science and applies them in the accomplishment of the purposes of education. Art is Man's work added to Nature's work.

A Mode of Teaching signifies the way in which a thing or subject is taught. It relates more directly to single actions and to single topics. It means less than the term "method." A mode of teaching may be excellent, or it may be in violation of all principles of education.

Manner of Teaching implies individual action. It is the usual way in which any particular teacher does the work. It does not relate so much to a mode of teaching as to the way of using a mode or a method.

A Method of Teaching implies an orderly use of modes of teaching. It is an arrangement for reaching a given point in the work by a series of acts or steps which it is expected will lead to that point. A method may be good or bad. When not founded on correct principles of education, it may lead to results widely different from those intended by the teacher.

A Plan of Teaching implies more than a method. It is an arrangement which may include the use of different methods for teaching one or more subjects—the methods being so connected as to form a chain of mutual dependencies. A plan of teaching may be limited to a single class, or extended to all the classes of a school.

A System of Education implies more than a plan of teaching, and more than methods. It includes plans for providing the means of education in several subjects for many schools. A system of education may be good, or bad, or incomplete. The kind must be determined by its degree of conformity to the principles of the science of education.

Development implies a gradual unfolding of that which is hidden or unknown; and it also relates to ex-

pansion and growth. *Development work*, in teaching, signifies a laying open of the subject by degrees, so that the pupil shall discover the idea, the fact, or the principle to be learned. The development, expansion, or growth takes place with the idea, the thought, and the powers of the mind, not with the things, nor the words. Ideas may be developed: words must be given; they *cannot* be developed. The *meaning* of words can be developed by expanding the ideas which they may represent.

Illustration signifies a making clear, easy to perceive or apprehend. In teaching, it relates to the use of things, pictures, and representations for exhibiting the idea, or fact, in a clear light, so that it may be readily understood. It belongs especially to the period of elementary education, yet it is also appropriate and valuable for advanced work of instruction.

Explanation signifies a making level, clearing the way, removing obstructions. In teaching, it relates more to the use of language, as a means of instruction, than to things and representations; hence it is more appropriate as a means of teaching pupils who have acquired a pretty full vocabulary of words that clearly symbolize to them a great number and variety of ideas. It is not a suitable means of instruction for young pupils.

Rote-teaching signifies causing pupils to commit to memory, by rote, words that represent no definite ideas to the mind; learning words as the parrot learns them—by sound—without their sense. Rote-teaching is usually accompanied with concert repetitions.

PRINCIPLES OF EDUCATION.

I. The development of the mind begins with the reception of sensations; and is carried forward by perceptions, and the formation of ideas.

II. The action and reaction between the external stimulants—material objects—and the mind's inherent powers constitutes the process of natural education. The influence of things upon mind, and of mind upon things, educates.

III. The intellectual action and exercise in which the learner's education essentially consists are performed by himself. It is what he does for himself—his personal experiences—not that which is done for him, that educates him.

IV. Ideas gained by personal experience are subjected by the mind to certain processes of elaboration, as classification, association, abstraction, generalization, judgment, and reasoning. Thus, ideas are incorporated with the organic life of the learner's mind.

V. Words are the conventional signs, the objective representations of ideas. Their value to the learner depends on his previous possession of the ideas they represent. Words, without ideas, are not knowledge. Therefore obtain ideas first, then words to represent them.

VI. Memory is the result of attention; and attention is the concentration of all the powers of the mind on the matter to be learned. The art of memory is the art of paying attention. Exact and concise language increases the power of remembering.

VII. The mind, in gaining knowledge for itself, attends first to the whole, then subdivides that into its parts, and from particular facts infers general truths. It discovers facts by analysis, but transmits them to others by synthesis. The teacher should follow this natural order, leading the pupil to the fact by analysis, but requiring him to show by synthesis that he has gained it.

VIII. Education is the cultivation of all the native powers of the child by exercising them in accordance with the laws of his being, with a view to development and growth. Repeated exercises of bodily organs give ease of action, and produce habits. Proper exercise of the mental powers give clearness of perception and certainty of knowledge. Proper exercise of any bodily organ, or mental or moral power, increases its strength.

IX. Right methods of education make the pupil an active doer, not a passive receiver; make him learn directly from things and acts, and become his own teacher.

X. The proper function of the teacher is that of a *stimulator* and *guide of the learner's work*, in a systematic building of knowledge into the mind, with a definite object. He should first discover the need of the child, awaken in him a desire to satisfy it, then lead him to the source of supply, and teach him to help himself.

XI. The teacher's true work, in the process of instruction, starts from that which is known to the learner, and proceeds to the kindred unknown which constitutes the matter to be learned. It causes that which is newly learned to become intimately associated with the previously known.

XII. Unknown objects and words can be illustrated and explained only by well-known objects and words. Teach unfamiliar things by the help of familiar things.

DIRECTIONS FOR TEACHERS.

By means of careful attention to proper directions and suggestions, relative to methods and principles of education, inexperienced teachers may secure valuable guides for leading themselves—

To use correct methods of instruction.
To acquire skill in the art of teaching.

Complete Fitness for Teaching implies the combination of knowledge and experience indicated by the following qualifications:

1. *A knowledge of the subjects of instruction.*
2. *A knowledge of the nature of the being to be taught.*
3. *A knowledge of the principles of education.*
4. *Skill in the use of the best methods of teaching.*
5. *Tact in the management of pupils.*

Mode of Procedure.—The work of true teaching includes in its processes the following important matters, and attention to each in its proper time and order.

The teacher must—

First.—*Discover the condition of the pupil's mind*, and its needs, as related to both its mental development and the subject-matter to be taught. *Then awaken in the pupil a desire to know that which he needs*, and guide him in the way to gratify this desire; and, while attending to these, teach him how to gain what is thus sought concerning the subject-matter of the lesson.

Second.—*Ascertain how the different minds gain knowledge* of the given subject,—which senses are chiefly used

for the purpose,—and then conduct the exercises of instruction so as to *employ two or more senses*, whenever possible, in order to secure the best attention and completeness of knowledge.

Third.—*Begin the lesson with things, or pictures, and facts*—not with definitions or rules. Bring the object, or subject-matter, with suitable illustrations, into such relations with the pupil's mind that each may act on the other so as effectively to cause the proper exercise of those powers by which knowledge is gained.

Fourth.—*By means of illustrations and questions lead the child to grasp the new idea or truth;* and, as soon as that is perceived, teach the word to express it, and in a manner that will thoroughly associate the word with the thought.

Fifth.—*Present the subject-matter of the lesson in the proper order*, proceeding from that which is already known by the learner to the most nearly related unknown, and lead the pupil to associate each newly-learned fact with what was previously known. Be careful to distinguish between facts which are new to the pupil and those that are already familiar to him.

Sixth.—*Unknown things and words can be illustrated and explained only by known things and words.* Do not attempt, therefore, to illustrate by the use of things not familiar to the pupils; nor to teach the meaning of words by the use of those not already well-known to them. Never try to illustrate that which is familiar by something unfamiliar.

Seventh.—*Ideas must be formed in the learner's mind*, and words given to represent them, before they can be expressed or communicated to others. The child learns by observation, examples, and practice, not by precepts,

rules, or theory. Precepts, rules, and theory aid him in remembering that which he learns by observation and practice. Provide your pupils with abundant means of learning by these modes, and see that sufficient attention is given to each.

Eighth.—*When ideas of a given subject cannot readily be obtained directly through the senses*, the subject-matter to be taught may be compared to some object or fact already familiar to the learner by his own experience. In using comparisons as a means of illustrating ideas, there should exist a true parallelism between the matter to be explained and the object, fact, or incident used for the illustration; and its application to the case in point should be made clearly apparent to the pupil. *Do not allow your illustration to cover up the subject*, and hide the fact to be taught, by making the comparison or illustration too elaborate.

Ninth.—*Follow the dictates of nature, and proceed from the whole to its parts.* Lead the child to understand through analysis, and to show that he knows by synthesis. Divide the difficulties of the subject into proper steps, and thus enable your pupils to surmount them. Direct attention to one thing at a time, and to each thing in its appropriate order. Do not attempt to keep attention too long upon one thing or fact.

Tenth.—*Remember that activity is a characteristic of childhood*, and that the child likes to try to do what it sees others do. Provide, therefore, examples of doing which may be imitated by the learner. In every lesson, where it is practicable, give the pupils something to do with their hands, and require them to say something about that which is done. Furnishing occupation that interests the pupils is the best means for maintaining order.

Eleventh.—*The attention of young children should be attracted, not forced, to the lesson;* and the attention to a given subject should not become burdensome to the learner. Activity on the part of the teacher is one of the means of securing attention; and constant employment of the pupils is another means. Partial attention of pupils implies partial teaching.

Twelfth.—*Proper repetitions deepen impressions. Both the facts and the language used to represent them are made secure in the memory by giving repeated attention to each.* Changes in the manner of directing the attention of pupils to the facts, and in the language used for describing them, may be made with profit to the learner; but in all cases let accuracy and conciseness of language aid the memory. Thoroughly knowing a thing is the surest way of remembering it.

Thirteenth.—*Do not use formal questions.* Put your questions on each lesson in several different forms, yet make them definite. Avoid leading questions, such as can be answered by yes, or no. *Shape each succeeding question with reference to the answers previously given, and the point to be gained.* Do not try to draw from a pupil, by questions, what he has never taken in; yet suitable questions may be used to lead him to discover that which he does not know. A lesson may be reviewed with much profit by requiring pupils to ask each other questions concerning it.

Fourteenth.—*Language is developed and cultivated by using it.* To use a language is to receive and express ideas through it. Children should be trained to *hear* and understand, and to give proof that they understand by expressing their thoughts in clear and accurate language. If you would *teach* much, *talk* but little.

Fifteenth.—*Train your pupils to do exactly what you request them to do*—no more, and no less. It will cultivate habits of attention; of quick and accurate understanding; of following directions correctly, and obeying orders fully. To accomplish this important result, let attention be given to secure it during the exercises of reading, spelling, arithmetic, writing, passing books, using slates, marching, standing, sitting, etc., until the habit of doing thus is formed in all the movements of the school. Such a habit is the corner-stone of excellent discipline. It is the key to success in maintaining good order.

Sixteenth.—*A summary, or short review, should end the lesson.* During this review all illustrations and aids to perception should be removed, and the pupil led to look within his own mind for the new fact or truth taught by the lesson. This is an important step in the development of mental power.

Seventeenth.—*Knowing what to teach, and knowing how to teach, are two very different things.* Knowing what to teach is an attainment of *knowledge.* Knowing how to teach is an attainment of *art.* Attend, therefore, both to the knowledge and to the art as the best means of success in teaching.

Eighteenth.—*Let your own life and work be worthy of imitation by your pupils.* Be truthful in acts as well as in words. Promptness, neatness, painstaking, politeness, and kindness may be effectively inculcated by your deeds, even though your words be few. With children, things seen are mightier than things heard, and example is more powerful than precept.

For more extended and explicit statements relating to *the nature of the things to be taught*, for a fuller exposition of *the principles of education*, and further *directions for*

teachers, in matters pertaining to the science and art of education, the reader is now invited to a careful consideration of "How Nature Teaches a Child," "Elements of Mental Activity," the *Mind*, and its "Powers of Mental Acquisition," its "Powers of Mental Reproduction," its "Powers of Human Reason," its "Powers of Moral Action," and its "Power of Willing," as treated in the following pages. Proper attention to these subjects will lead to a clearer understanding of the true relations which should exist between the learner and the teacher, to the use of better methods of instruction, to skill in the art of teaching, and to more satisfactory results in education.

HOW NATURE TEACHES A CHILD.

"For some time during the early years of childhood Nature is the chief, if not the only, teacher; and the contrast between her success at that time and the success of the teacher who succeeds her is very remarkable, and deserving of consideration. When we examine this process in the case of infants, we see Nature acting without interference, and with undeviating success. Within a few months after the child has attained some degree of consciousness, we find that Nature, under every disadvantage of body and mind, has succeeded in communicating to the infant mind an amount of knowledge which, when examined in detail, appears truly wonderful. The child has been taught to know his relatives and friends; he has acquired the ability to use his limbs, and muscles, and organs of sense. He has become sufficiently familiar with the form, the color, the texture, and the names of a hundred articles of dress, of furniture, of food, and of amusements, to be able readily to distinguish each; and all of this has been acquired without fatigue, and with pure delight. He compares objects, as may be seen in his choosing those things which please him, and rejecting those which he dislikes. And, above all, along with this substantial knowledge of things the child has been taught to understand a language and to speak it. The fact that all of this has been accomplished by a child of only three or four years of age is so common, that the mysterious principles which it involves are generally overlooked. We thoughtlessly allow them to escape observation, as if they were matters of instinct, and to be ranked with the spider's catching its prey, or the bird's building its nest.

"The benefits accruing to education from successfully imitating Nature in this department of her training process would be incalculable, not only in adding to the amount of knowledge com-

municated, but in the ease and delight which the young would experience in acquiring it. The rapidity of acquisition in gaining knowledge, and the pleasure attending it, are greatest during the time that Nature is the teacher. Both the rapidity and the pleasure are generally checked by the mismanagement of those who supersede Nature with the processes of school instruction. The proof of this is found in the fact that, although a child is much less capable of acquiring knowledge between one and five years of age than he is between eight and twelve, yet the amount of knowledge generally derived from school exercises during the four latter years bears no proportion to those of the former when Nature alone was the teacher. In the one case his intellectual attainments were acquired with little or no fatigue, and the acquisition was a continued source of pleasure, while in the other quite the reverse is usually the condition."*

Now, if we could only cause the knowledge sought to be imparted in the school-room to glide as sweetly and clearly into the mind as that of Nature's teaching, we should not only greatly aid natural education, but get rid of much of the dreary endurance of school-hours, of that stolid lending of the ears without hearing, that objectless looking without seeing, and those repetitions of words without the acquisition of knowledge.

The amusements of early childhood furnish instructive hints as to suitable means for the education of young children. When the child has acquired the power of using its hands in holding and moving objects, he soon makes a variety of experiments by moving those within his reach. If he notices a new effect by moving an object, he is eager to repeat it. When he throws a spoon on the floor, and hears the jingling noise, if another spoon is given him he is sure to throw it down, expecting to hear the same noise. If a piece of wood be given him, he soon finds that the same noise does not occur when it

* *The Philosophy of Education*, by James Gall, of Edinburgh.

is thrown down, and he loses the desire to repeat the experiment. But, so long as the noise that pleased him is repeated, he takes pleasure in throwing down the object.

If two objects be given him, only one of which will produce a noise when thrown down, he soon finds out the difference, and wants only the one which produces the noise. This is the *inductive method* by which Nature teaches her scholars. She makes their plays their most instructive lessons.

"Nature furnishes knowledge by object-lessons, and she trains the active powers by making them act. She has given capability of action, and she develops this capability by presenting occasions for its exercise. She makes her pupil learn to do by doing. She gives him no grammar of seeing, hearing, and feeling; she gives no compendiums of abstract principles. Action—action is her maxim of training; and things—things are the objects of her lessons. She adopts much repetition in her teaching, in order that the difficulty may become easy, and 'use become second nature.' In physical training, 'use legs and have legs' is one of her maxims, and she acts analogously in regard to mental and moral training. She teaches quietly. She does not continually interrupt her pupil, even when he blunders, by outcries and objurgations. She bides her time; and, by prompting him to continued action, and inducing him to think about what he is doing, and correct his errors himself, makes his very blunders fruitful in instruction. She does not anxiously intervene to prevent the consequences of his actions; she allows him to experience them, that he may learn prudence; sometimes even letting him burn his fingers, that he may gain at once a significant lesson in physics, and also the moral lesson involved in the ministry of pain. * * *

"Nature makes her pupil teach himself. She does not explain the difference between hard and soft objects—she says, Feel them; between this fact and that she says, Place them side by side and mark the difference yourself; and generally she says to her pupil, Don't ask me to tell you anything that you can find out for yourself. * * *

"She mingles lessons in physics, language, morality all together. Her main business seems to be the training of faculty; and she subordinates to this the orderly acquisition of knowledge by her pupils."*

The first step of Nature's process, in the cultivation of the infant mind, is the *voluntary* exercise of the powers of mental acquisition. A child may be surrounded with a thousand objects, and these may act on the organs of sense, but *until the mind voluntarily occupies itself with one or more of these sensations there can be no mental acquisition or culture.* Education, then, does not depend upon the number of objects, or the multitude of subjects which may be employed by the teacher, but upon those only which the mind really looks at, observes, and thinks about. *The voluntary exercise of the mind lies at the beginning of all mental development and acquisition.* Impressions may be received, and these may be blended into ideas, but these ideas must also be symbolized with words, and associations formed, and the ideas repeated or thought over, by means of the words representing them, in order to produce development and growth in knowledge.

It is the exercise of the pupil's own mind that constitutes his acts of learning. Learning is self-teaching. The mental acts by which knowledge is gained are acts of the pupil. The teacher cannot think for the pupil any more than he can sleep or eat for him. He can only induce, stimulate, and awaken thoughts and desires that will lead the pupil to acquire knowledge.

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* *Lectures on the Science and Art of Education*, by Joseph Payne, late Professor in the College of Preceptors, London.

ELEMENTS OF MENTAL ACTIVITY.

THE external world acts upon, and stimulates the mind to act through, the nervous system. Mind and matter act, and each are acted upon by the other. The action of mind and matter produces changes. Action and change constitute *motion*. Heat, light, color, and sound are produced by motion. Touch and feeling, taste and smell, are also dependent upon motion. The different varieties of motion which produce these various phenomena experienced by our minds exist in the form of changes, or vibrations, among the atoms of matter. These several varieties of vibrations, it is believed, are transmitted to the different senses in the form of waves, or *undulations*.

The vibrations which produce sound are communicated to the sense of hearing by *undulations of the atmosphere*. Vibrations produce heat; and light and color are transmitted to the senses of feeling and seeing by *undulations of ether*—a medium believed to pervade all space, including the interior of all substances. The difference between sounds is caused by the difference in the rapidity of the vibrations and the length of the air-waves. The differences in heat, light, and colors depend upon the rapidity of the vibrations that produce them, and, with light and colors, on the length of the ethereal undulations also.

The sense of hearing can be acted upon only within a certain range of air-vibrations. If these are less rapid than *sixteen* in a second, the sound will be too low for the human ear to perceive it. If the vibrations are more rapid than about 40,000 per second, the sound becomes

too high for perception by human ears. It is possible, however, that some animals may possess powers of perceiving lower sounds than any which man hears; while it is probable that there are others with such acute senses that they can hear sounds so high that we have no knowledge of their existence.

The vibrations which produce *red* light are slower, and the ethereal undulations are larger, than those which produce *purple*. In red light 39,000 waves occupy but one inch of space, while the number of vibrations is at least 475,000,000,000,000 per second. In *purple* light 57,500 waves occupy one inch of space, and the number of vibrations per second is 700,000,000,000,000.

Sound travels through the atmosphere at the rate of 1100 *feet* per second. Light travels at the rate of 192,000 *miles* per second, or more than 900,000 times faster than sound. Thus, it may readily be seen that the two prominent modifying conditions in motion, which produce the several sensations manifested to the human mind, are *time* and *space*. Both of these are generated by motion. Time is the *internal* measure of motion, and space is the measure of motion *externally*.

It has already been shown that two classes of sensations —those which act through the senses of hearing and seeing—are the result of motion. Turning now to chemical effects, we find that *motion of the particles* of matter produces the results observed by the senses of taste and smell. Thus we perceive that *motion is the common ground on which mind and the material world can meet.* It is the universal medium of their communion.

How Ideas are Formed. — The material world is known to sense simply by virtue of, and in relation to, the motion of its particles. These motions are continued from the organs of sense, by the nervous system, to the

mind, which in its turn reacts upon the material world, through the nerves of motion, to ascertain the cause of the sensations, and thus come perceptions; while through and by the aid of perceptions concepts are formed. These are the *mental residua** which are produced in the mind, through the activities of the different senses, from objects that comes before it. These *residua* spontaneously blend together, forming an *idea* of the object. This is the beginning of *intelligence.*

When an ordinary object is placed before us, the leading features that first arrest the attention of the mind are those of which impressions may be taken in through the sense of *sight*, as color, shape, size, materials, etc., because this sense is the most intellectual, and through experience attains the ability of receiving a greater amount and variety of information from an object than either of the other senses. The sense of *touch* gives us impressions of hardness and smoothness, while impressions of *sound*, *scent*, and *taste* are each conveyed through their respective organs. The mind may receive sensations and information from several senses at the same time.

Suppose the object before the mind to be an orange: all the concepts derived from its shape, color, size, smoothness, and its qualities of scent, taste, etc., or the various mental *residua* of this object, which are left in the mind by means of each separate sense, would unite, unconsciously, in forming the *idea* of an orange. It is by this process of blending impressions that *ideas are formed* out of simple concepts, or mental impressions.

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* The term "residua" is not used here in any materialistic sense, nor as a representative of any system of mental philosophy, but simply as a *symbol* for accumulated "concepts," or thoughts, or the simplest elements of knowledge which the mind receives through the senses, or of that mental operation, by whatever term it may be known, or whatever may be its modes of action, which is recognized as the accumulation of that which becomes our knowledge of the external world—that which *is*, or becomes, or produces thoughts.

Generalization.—These same laws, by which various impressions blend together in forming ideas, also *govern the union of similar ideas in the formation of general ones.* We may trace this blending process from a very early period of childhood, and observe the combinations becoming larger and larger in proportion as the mind grows up toward maturity. Here, then, is the beginning of that mental process and that operation of the mind which may be called *generalization.* It is through these natural classifications, based upon the *likeness* and *unlikeness* of things, that knowledge grows from the concrete to the abstract. Thus, the law of similarity not only lies at the basis of those processes by which the mental *residua* are blended into ideas, but also of those simple classifications by which ideas are moulded into masses, and generalizations established. By extending the classification of ideas, by likeness and unlikeness, to the formation of groups of ideas, and establishing a connection between them by associating these groups together, we have the origin of that kind of knowledge which is called *experience.*

As the child becomes older, the range of its experience enlarges, the elements of perception are more readily formed into simple ideas, and these simple ideas tend more and more to merge into general ones. Even words, which are symbols of our generalized ideas, represent to the child a simpler combination of ideas than the same words do to one of wider experience. Suppose the word *river* be heard. To the child it might convey only an idea of a single stream which he had seen; but to the adult of large experience it would convey an indefinite number of *river-ideas,* which had formed in his mind out of the past observations made by himself and others, all of which now have blended into a more comprehensive or general form, under the single word *river.*

Not only are our ideas of material objects formed by the blending of impressions obtained through several senses, but ideas of abstract terms, as love, hatred, pity, anger, virtue, etc., are formed in the same way; they take their origin primarily from certain manifestations which we see in others, or are conscious of in ourselves. Although these manifestations are various, yet in the course of our experience the impressions which they leave blend together, so as to form combinations that represent to the mind the ideas expressed by the terms love, hate, pity, anger, virtue, etc. Since the impressions which unite in the formation of these several ideas differ according to the mental experiences of each individual, it must not be supposed that the words which stand as symbols for these ideas will convey them with exactly the same force and clearness to each mind.

The fulness, clearness, and accuracy of the ideas received from words by each person depend upon the number of "concepts," or the amount of mental *residua* which those words symbolize to each. Words signify much or little to each one of us, as our mental accumulations associated with those words are many or few.

MAN'S NATURE AND POWERS.

MAN possesses two widely different natures: one is *physical*, the other *spiritual.* As a physical being, he is composed of *bones*, or a frame; of muscles, or organs of motion; of *nerves* and *ganglia*, or organs of sensation. As a *spiritual* being, man is composed of a *mind*, which acts through specific bodily organs in all its intercourse with the material world.

The action of the physical nature may be called *animal power;* the action of the spiritual nature may be called *mental power.* We are conscious of the operations of both of these powers, and may control, or influence, their action by our will. But there is a third power, which belongs chiefly to our physical nature, that is wholly beyond both our consciousness and our control. This is the *Vital Power*, or that force by which the physical system is built up and kept in repair, and the processes of animal life carried on. This power is common also to the entire animal and vegetable world.

THE MIND.

The *mind* is that which *feels*, and *thinks*, and *knows.* Its *organs* are the *brain* and *nerves.* The mind is spiritual; the brain and nerves are material. The mind is said to possess various *faculties;* but these denote only the different modes in which its power is manifested.

The Senses.—The *senses* are those powers by which the mind holds communication with the external world.

Their various modes of manifestation are called *taste*, *smell*, *sight*, *hearing*, *feeling*, and the *muscular sense*. Their *special bodily organs* are the *tongue*, the *nose*, the *eye*, the *ear*, the *skin*, and the *muscles*. The means of connection and communication between these external organs of sense and the mind are the *nerves*.

Nerves.—Each organ of sense has its peculiar nerve connecting it with the brain, the chief organ of the mind. To the anatomist these nerves all appear alike, when separated from the body. But each is affected in its own peculiar way: one by light, another by sound, another by smell, another by touch, another by taste. Neither of them is affected by that which produces sensation in the other. Sound does not affect the nerve of sight; light does not affect the nerve of hearing; taste does not affect the nerve of smell, and so on. But precisely *how the mind acts* through the brain and nerves, and the various organs of sensation, no man can fully explain. However, that the mind possesses native tendencies to act through its several organs of sense, is as evident as that the life-principle of seeds contains the natural tendency to develop into a plant after its own kind. But both the mind and the life-principle need the appropriate conditions, which can be supplied by the influences of external objects, to bring forth their development.

Sensations.—Sensations are those brief influences, or impressions, which external objects produce upon the mind through its special bodily organs of sense. A sensation lasts only during the time that its cause acts upon the organ of sense. It is a fundamental element of knowledge.

Perception and Perceptiveness.—By means of the nerves such a communication exists between the outward organs of sense and the mind that notice is taken of the

sensations. This notice, or attention, is called *perception.* It is a manifestation of *perceptiveness.*

Perceptiveness is that power, or natural tendency of the mind, to act in perceiving whenever the occasion for action occurs. *Perception* is the action of *perceptiveness.* When its action ceases, perception ceases; but *perceptiveness* is a permanent power, or tendency of the mind, which is always ready to act whenever the appropriate excitement affects it.

Perception constitutes the first mental activity in the process of gaining knowledge.

Conception.—When the object which caused the action of perceptiveness is removed, mere perception ceases; but, during the presence of the object, and the activity of the perceptive power, the mind receives a permanent impression, or image, or knowledge of it. This image, or knowledge, is sometimes called a *concept.* Such an impression, or image, might be termed *a simple element of knowledge*, or a *mental residua;** for it is these elements of knowledge, or impressions, which accumulate and enter into the various forms and combinations that make up those attainments which are commonly understood by knowledge of an object. That *mental power* which takes the impression, or gains these elements of knowledge of the object in such a manner that the image, or knowledge, may be retained and recalled without the presence of the object, is often called *conception.*

This mental power of receiving and retaining the elements of knowledge of objects, whether called *conception*, or *intuition*, or *apprehension*, or *perceptive faculties*, or by some other name, is the *primary knowledge-gatherer* of the mind. It collects elements of knowledge that aid in other mental operations. It furnishes the means of rec-

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* See note on page 361.

ognizing the same objects when they come again under notice.

"We are following the plainest dictates of consciousness, we avoid a thousand difficulties, and we get a solid ground on which to rest and build, when we maintain that the mind in its first exercises acquires knowledge; not, indeed, scientific, or arranged; not of qualities of objects and classes of objects, but still knowledge—the knowledge of things presenting themselves, and *as* they present themselves; which knowledge, individual and concrete, is the foundation of all other knowledge—abstract, general, and deductive. In particular, the mind is so constituted as to attain a knowledge of body or of material objects. It is through the bodily organism that the intelligence of man attains its knowledge of all material objects beyond. This is true of the infant mind; it is true also of the mature mind."*

ORGANS OF SENSE.

The several organs of sense are the means by which the mind gains the elements of knowledge from various objects. It is proper, therefore, to inquire what are the original elements of knowledge which the mind receives through each of these organs of sense, that the manner of the mind's activity may be so well understood as to enable teachers readily to devise suitable exercises for increasing its facilities of action through each of these organs.

Seeing.—Through the organs of sight objects are perceived chiefly by means of their form and color; but it is experience, or the combined elements of knowledge derived through the senses of sight, touch, and the muscular sense, and sometimes of hearing also, which enables the mind to attain definite knowledge of the form, size, and distance of objects. An infant has perfect eyes, yet

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* *Intuitions of the Mind*, by Dr. McCosh.

it will try to reach distant objects as well as those near it, apparently having no idea that all objects are not equally near until it has learned to the contrary by its own experience. Neither does it distinguish one form or color from another until it has learned to do so through experience.

Children are born with all the senses, but *facility in the use of each must be acquired.* During infancy the earliest attainments in knowledge are the results of experience; so, also, does the mind add to its stock of knowledge by its experience during all subsequent stages of learning. It is exercise, practice, experience that develops mental powers as well as the physical powers. Whatever exercises give to the mind greater facility of action through its several organs of sense will increase its power and extend its knowledge. Hence the importance of giving special attention, during early steps of education, to appropriate means for extending the experience of the mental powers by supplying suitable exercises for these organs of sense.

The sense of sight may be cultivated by observing the physical properties of objects, such as form, color, number, surface, size, position, distance, motion, rest, and solidity, and their various combinations and uses. Among the objects appropriate for this purpose are the utensils and tools for the house, farm, or shop, furniture, machinery, pictures, models, trees, leaves, flowers, birds, quadrupeds, insects, shells, pebbles, and occupations, and the various objects of nature and art. Although somewhat familiar to children, by casually seeing them, these several objects may be so employed by the teacher as to arrest their volatile attention, and win them to habits of *close and minute observation*, and lead them to acquire the power of ready and accurate description.

The eye is par excellence *the intellectual sense.* Light is

the symbol by which we most naturally represent knowledge, and to *see a thing* is used as an equivalent for *understanding it.* Sight is of far greater importance in intellectual education than hearing, yet the latter is commonly made the principal medium of school instruction, notwithstanding it is comparatively of much less value than the former.

Hearing. — The mind, through its organ of hearing, perceives sounds. At first, to the young child, those sounds appear to exist within the organ affected—the ear. At length experience teaches that it proceeds from a body without, and further experience teaches the sources of the different sounds; and by this means the child learns to know certain objects by their sounds. Subsequent observation enables him to recognize the various characteristics of sound, and thus to feel similar emotions upon the recurrence of the same sounds.

Hearing is cultivated by distinguishing sounds of various kinds, as those produced by bells and other sonorous objects, or by different animals, or by the human voice in conversation, elocution, and music. Training children in habits of correct enunciation of words, and in the distinct utterance of the elementary sounds of language, singly and in combinations, will aid materially in the cultivation of the sense of hearing.

While *sight* is naturally associated with the *intellect*, *hearing* is more nearly allied to the *feelings.* Tones of voice betoken emotions which no words can express. Words are but sounds as they strike the ear, yet what power they possess in moulding, recalling, and stimulating our ideas! The sweetest delights of music, the richest charms of society, the various tones of the human voice in expressions of love, joy, sorrow, anger, remorse, and fear—all indicate developments of the mind through the

sense of *hearing*. All of these conditions and experiences become possible by means of the air that surrounds us, and the susceptibility of cultivated organs of hearing. And, notwithstanding all this, the exercises of the school-room too seldom have any definite reference to training this sense of hearing in habits of accuracy, acuteness, and delicacy of perception. Some success is attained in cultivating the *singing voice* in smoothness and sweetness, but too little is done toward cultivating sweetness and richness of the *speaking voice*, as used in conversation, reading, etc.

As illustrations of the great degree of cultivation to which the organs of *hearing* may be brought, and the wide range for training both the ear and the human voice, through the development of this sense, we present the following statements:

Probably the lowest sound which the human ear can perceive is produced by about *sixteen* vibrations per second. The lowest note by the open organ-pipe, thirty-two feet long, is formed by *thirty-two* vibrations of air in a second. The highest *musical* note which can be produced is supposed to be formed by about 5000 vibrations per second.

In the common seven-octave piano the lowest note of the bass (A) contains about *twenty-seven* vibrations per second, and the highest note of the treble about 3500 vibrations in a second. The musical ear is able to discriminate innumerable varieties and combinations of vibrations lying between these extremes. But what may be said of the extent and acuteness of those cultivated organs of hearing which enables the leader of a large orchestra, where the number and variety of the vibrations are such as to entirely baffle their computation by arithmetic, to detect a single note or part of a vibration out of tune or time, and even to point out the offender!

The range of human *hearing*, between the lowest sound that is perceived by the ear, or even the lowest note of the organ, and

the highest known cry of insects, which is supposed to be formed by about 40,000 vibrations per second, includes about ten octaves. The compass of the human *voice*, from the lowest note of the bass or male voice, which is produced by about *sixty* vibrations per second, to the highest note of the soprano, which is composed of about 1044 vibrations per second, is within four octaves. The compass of good, common voices is within two octaves; very few extend so far as three. Madame Catalani's voice, it is said, embraced three and a half octaves.

"Every musical instrument, every animal, every object in nature has its peculiar quality of voice. Where the sound is produced by a living agent, it is again further modified by the circumstances of skill in the performer, and by the sentiment under which the tones are produced. By this variety in note and quality the practised ear is enabled not only to distinguish the originating cause of a sound, but to determine the sentiment which called it forth."

Knowing that such results are possible from developing the sense of hearing, also that much depends upon its power in learning to read with clearness and beauty of expression, and that it contributes largely to the cultivation and richness of the human voice, thus adding to the charms of conversation, the importance of giving special attention to training this sense in habits of acuteness of hearing, accuracy in distinguishing tones, and to training the voice in producing the tones with facility, becomes so apparent that it can hardly receive too much attention in the exercises of school.

Feeling or Touch.—"The organ of touch consists of the fine extremities of the nerves distributed over the whole surface of the body, and protected by the epidermis, or outer skin." The skin is, therefore, commonly called the organ of touch. Its greatest power is centred in the tips of the fingers. The sensation of feeling is chiefly dependent upon temperature.

At first thought it may seem of little importance to cultivate the sense of touch; but if we consider the many arts and professions which require delicate sensitiveness and accuracy of touch, we shall find that its culture is a matter worthy of much attention.

This sense may be cultivated by perceiving such properties of bodies as hardness, softness, smoothness, roughness, heat, cold, and all those minute sensations which come to us through the tips of the fingers.

Muscular Sense.—That which is known as the *muscular sense* is intimately connected with *feeling*, and is the peculiar manifestation of the sense of touch which takes cognizance of resistance, and enables the mind to obtain ideas of size, distance, position, form, and weight.

The cultivation of the muscular sense is important, not only because this is the organ of force, but because it is also necessary to bring the muscles under the complete control of the mind, so that their movements may be made with facility and precision, and thus contribute to skill of workmanship and manual execution in any trade, art, or occupation. It may be cultivated by observing those sensations which arise from *resistance* and *pressure*, such as weight, strength, toughness, and elasticity, or from a push, a prick, or a blow.

Smelling.—Through the organs of smell odors are perceived; but at first the knowledge of the odor does not extend outside of the part affected—the nostrils. Experience teaches the child that there is an object beyond the nose from which the smell proceeds. Further observations teach the child to connect particular odors with particular objects, so that at length the mind comes to recognize objects by their odors through the sense of smell alone.

The sense of smell may be so educated as to become an important aid in the preservation of life and health. Dr. Southwood Smith says: "If the poisonous exhalations in the atmosphere could be seen rising in snakish spirals from sewers, crawling along damp alleys, and entering our dwellings, we should fear to walk along our streets."

The sense of smell may be so trained as to distinguish between smells that are simply disagreeable and those that indicate miasma and disease. Such a cultivation of this sense would become an excellent means of security against many forms of disease.

Tasting.—The power to distinguish the qualities of sweetness, sourness, bitterness, and saltness we call the sense of *taste*. The *tongue* is the principal organ of this sense; *taste* is its function; *savor* is the general sensation produced. Taste is the most easily changed of all our senses. It will accommodate itself to almost anything; therefore *it requires, more than any other sense, the constant guidance of reason.* This fact should be impressed upon the minds of the young, and they should be led to cultivate a desire for those kinds of foods and drinks which are known to be conducive to health, and to increase a dislike for those things which, notwithstanding they may become pleasant to the taste, are nevertheless known to be injurious to health.

The senses of *smell* and of *taste* contribute a far less amount of materials toward intellectual education than those of seeing, hearing, and feeling. The cause of this exists in the fact that only the faintest impressions of odors and tastes can be recalled by the mind, when the objects are absent to which these qualities belong.

"It is not quite certain that we can think of even the most pungent tastes and smells entirely abstracted from the *visible* ac-

companiments of these sensations. Cayenne pepper affects the tongue much more vividly than its bright color does the eye; but in attempting to think of this acrid condiment, its visible appearance prevails entirely over the feeble traces left upon the mind by the taste, so that one can mentally *see* it much sooner than mentally *taste* it."*

Those impressions that come to us through the senses which are most nearly allied to our physical being can be but imperfectly recalled in the absence of the objects which produce them; while those of a more intellectual character remain in the mind, and may be recalled, without the presence of their several objects, with a vividness almost equalling reality.

CLASSIFICATION OF KNOWLEDGE GAINED BY THE SENSES.

The following tabular classification will show at a glance the several bodily organs of sense, their respective sensations, and the chief kinds of knowledge that are obtained through the instrumentality of each sense:†

Organs of Sense.	Names of Sensations.	Kinds of Knowledge Gained through each of the Senses.
Eye........	Seeing.....	Light, color, lustre, form, number, size, surface, solidity, position, distance, motion, rest.
Ear........	Hearing...	Sound and its qualities, speech, music, direction, distance.
Skin..... Fingers..	Touch..... Feeling ...	Softness, hardness, smoothness, roughness, heat, cold.
Muscles....	Muscular..	Resistance, pressure, weight, toughness, elasticity, force, size, position, distance, direction.
Nose	Smelling....	Odor, fragrance, etc.
Tongue....	Tasting...	Sweetness, bitterness, saltness, savoriness, acidity, astringency, pungency, flavors, etc.

* *Home Education*, by Isaac Taylor.

† See statements concerning the *organs of sense—seeing*, *hearing*, *feeling* or *touch*, *muscular sense*, *smelling*, *tasting*—in the preceding pages.

DEVELOPING THE POWERS OF MIND.

Cultivating Perceptiveness.—This faculty, or mental power, depends for its development and strength upon the activity and acuteness of *the several senses*. Whatever will render the perceptions through the eye more clear, keen, and certain, and those through the ear more acute and quick, will greatly increase the intellectual strength of the faculty of perceptiveness. As a clear, strong, and healthy *sensation* is indispensable to a distinct *perception*, so are clear, forcible, and true *perceptions* necessary to accuracy and clearness of *conceptions* and the successful acquisition of correct knowledge.

A child, while watching the different objects around it, observing their forms, colors, number, and sounds, and examining their structures, is employed in a work in which it should be encouraged as much as possible, since it is by such means that the powers of perception and conception are cultivated, and valuable materials of knowledge added to the mind. Therefore, to cultivate this power of *perceptiveness* in a right manner, means should be devised for just such exercises as will attract the attention of the perceptive powers, and lead to careful observation of properties and qualities of objects. This may be accomplished by placing before children objects that interest them and excite their curiosity, and by leading them to observe more carefully, and minutely, and systematically the shape, color, size, qualities, and uses of common objects.

Since the elements of our knowledge of the external world are acquired, in the first instance, through the

organs of sense, it becomes highly important that much attention should be given to their training during the elementary steps of education. Yet this important work, which lies at the very threshold of all sound education, is commonly neglected in the plans of school instruction, or left in the hands of unskilful and inexperienced teachers.

"The organs of sense are the very gate-ways by which knowledge must enter the mind; but if these gate-ways are only partially opened, or encumbered and blocked up, knowledge must come through them with difficulty, and often with an aspect distorted by the passage.

"I would recommend that the organs of sense should be carefully tested, during the preliminary steps of education, to ascertain whether they severally discharge their functions perfectly. Organic defects are more common than many suppose; and they often remain undetected, even by mothers, until the period of acquisitiveness has passed away. The child, at this early age, has no means of discovering its own organic deficiency; it has always seen things in a haze, or heard sounds confusedly, and it takes these sensations as the natural and regular effects of their several causes; it has no different standard of comparison, for reason is not yet sufficiently developed to effect that subtle comparison with the sensations and perceptions of other children which might lead to a consciousness of inferior perceptions and conceptions.

"Many children are deemed stupid when they are simply shut in from the true comprehension of things. There may be a powerful intellect behind a defective organization. If a child be a little deaf, so that the words of the teacher reach the mind in truncated and scarcely articulate sounds, there is nothing more natural than that a child should mistake their meaning, and give a wrong answer. The mischief in too many cases is that this misapprehension is attributed to dulness or obstinacy, and that the child is punished in some manner for what no intellectual brightness or industry can remedy. Now, a child slightly deaf can hardly profit by the instruction of the teacher without spe-

cial attention, and it is, therefore, frequently regarded as dull and sulky. It mistakes his orders, and is punished for disobedience; it hears nothing of his affectionate tones, does not therefore respond, and is set down as sullen and unlovable. In like manner a near-sighted child or a long-sighted child is frequently reproved for inattention, although the mind may be struggling to force its way through the obstructed channels of vision. Even where the teacher pities the child's deficiency, and forbears to punish it, it is too frequently allowed to pass out of view as a natural defect of the mind, and therefore irremediable. The evils that result from compelling the mind to work without attention to these imperfect instruments can hardly be exaggerated.

"Where defects are discovered they may be partly overcome, if not entirely removed, by strengthening the association between the defective senses and those that are not defective. The organs may be trained, by judicious exercise, to a far higher degree of accuracy and power than they possess in the uncultured state. If all disturbing and vitiating causes be removed from the channels through which knowledge is derived, it must flow in upon the mind in a fuller and purer stream when the source that supplies it is abundant.

"Material objects and sensible events should constitute the chief lessons of childhood. The knowledge a child acquires by the exercise of his own senses penetrates the intellect more deeply and pervades it more completely than any other; for it is the impression which Nature herself makes upon the mind by direct contact, whilst all other media of instruction are but representations, more or less imperfect, of nature. The originals and types of all erudition must be thus stored up by direct perception, for without it words could have no significance.

"A fine exercise for perceptiveness, and for making distinct perception a habit, is to take pupils to parks, gardens, groves, workshops, manufactories, etc., and afterward to get them to write out descriptions of all they saw and heard that came to their knowledge through each or all the organs of sense."*

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* Arranged from *Human Culture*, by M. A. Garvey.

In exercises of this kind the younger pupils might be requested to mention the names of the objects which they saw; to describe their form, color, size, position, and uses; to state what sounds were heard; whether the atmosphere was fresh or unpleasant; what refreshments, fruits, etc., were eaten; whether the weather was warm or cold; whether the distance was long or short, etc. Of course these descriptions would be very imperfect at first, but practice would soon give the pupils such powers of observation and description as would lead to the very best kind of education.

POWERS OF MENTAL ACQUISITION.

Their Cultivation.—The various mental powers by which the elements of knowledge are gained and ideas formed are often called the *Perceptive Faculties*. The term *Powers of Mental Acquisition* is here used to designate that class of faculties, or powers, which causes those active operations that take place at the several gate-ways of knowledge, and transmit information to the mind from the outward world; and those also which aid to combine, arrange, classify, and retain this information, so that it may become permanent knowledge. These powers are manifested in the mind's ability to gain a knowledge of form, color, number, size, position, distance, order, weight, sound, time, etc., and in the ability to compare, combine, construct, classify, and arrange.

Phrenologists use terms indicating the kinds of ideas obtained from the principal qualities of objects to designate these several mental powers; and each of these powers is called by them an organ of the mind, and is assigned a definite position on the head.

Our powers of mental acquisition may be cultivated by attentively observing likeness and unlikeness, or resemblances and differences, in whatever comes within the range of the senses. It is by such an exercise of the senses as will impart to them activity, acuteness, accuracy, facility, and strength that the desired cultivation must be accomplished. Appropriate exercises of the organs of sense will add these qualities to the several powers of the mind; and this addition of more activity and strength to the mind by experience constitutes that which is understood by the terms *development*, *cultivation*, *education*.

As the elements of thought are multiplied by observation ideas are more and more readily formed; and thus the more we learn correctly, the more easily can we acquire additional knowledge.

OBSERVATION.

This is not a faculty of the mind, but rather a common term used to express the results of the action of several mental powers, prominent among which are those of perceptiveness, conception, and attention. Inasmuch as in the practical exercises of education the combined action of these powers of mental acquisition is chiefly considered, rather than their individual qualities, I shall here treat of them in this united capacity, under the name of *Observation*.

The act of observing springs from the natural desire to know. This act, in turn, reacts on that desire, stimulating it and increasing the power of observation. A child, whose powers of mental acquisition have been properly exercised, will acquire the *habit of observation*, and thus increase his ability to gain knowledge.

To observe is not merely to see, and hear, and feel, but *to see, and hear, and feel with such attention as to perceive clearly and accurately.* The more the observation is thus employed, the more will be brought into the view of the mind by sensations and perceptions.

Observation should first be employed upon those qualities which act directly upon the senses; since the more these are noticed, and the more ideas of them are associated together, the better will be laid the foundation for future knowledge. In the works of nature there is much more to excite the observation of children, as well as much more that can be made the subjects of pleasing instruction, than in the works of art; but the judicious instructor will not be at a loss to find numerous objects

within doors, as well as without, to thus aid in the process of mental culture, especially such as will stimulate the mind to a careful observation of nature.

The habit of observation depends, in part, upon the general culture of the mind, especially upon the associated thoughts and feelings connected with external objects. The farmer's boy, with all the advantages that the country and his employment afford him for the excitement of his observation, where no attention has been given to this kind of education, sometimes will be found extremely deficient in the habit of careful observation. His perceptions are dull from lack of exercise, and his mind is scarcely awakened. Sensations often repeated, without being perceived, cease to excite the notice of the mind, and its noble powers lie dormant from want of exercise.

Those who have been engaged in the business of education well know the different degrees of accuracy and quickness of observation that are found in children, and also how important it is, for progress in intellectual culture, that this habit should be early formed. Childhood is the period of observation, and it should then be made a primary object in training. Observation is of essential value in every branch of education, and in every department of life. The successful acquisition of every science depending upon experiment—indeed, the acquisition of knowledge of every kind which depends upon the exercise of the perceptive faculties, the cultivation of taste, information relating to the common concerns of life, and even the civilities of society—require a constant exercise of this habit.

So long as the observation of a child does not rest merely with the immediate objects of perception, but continues to connect them with that information which the instructor communicates, or which has been derived from

past observation, it is very usefully employed. Whatever method is found to invigorate and render the powers of observation more accurate should be frequently employed. Till the understanding has made considerable progress, this should be a leading object in intellectual culture; and in every period of it the habit should be frequently brought into use. By a proper exercise of it the memory and judgment are directly cultivated; and, while it strengthens and rouses the energy of the mind, it furnishes it with some of the most serviceable materials for the understanding.*

Exercises for the culture of observation in young children should be limited to a few minutes at one time; but these may be gradually lengthened as the children acquire greater command over their attention, and manifest a greater desire for information. Many objects should, at first, be offered successively to their notice, because *the immaturity of their minds does not permit a minute investigation of each;* and attention can then be kept up only by variety and novelty. As their powers of observation increase by exercise, the subjects for consideration may be gradually diminished, until one may suffice for a single lesson. When advancement has been made, they may be required to attend more closely to a single object for a greater length of time, and thus attain more thoroughness of information. But let it never be forgotten that long confinement and protracted application to one subject should be carefully avoided with young children. There should be no gloom, no misery, associated with the first intellectual exertions. Happiness is the privilege of childhood.

It has already been shown that external objects exert an influence upon the mind by means of the senses, and

* *Principles of Education*, by Rev. L. Carpenter, LL.D., contains many of the ideas presented in the foregoing statements.

that the influences which are thus produced remain with the mind as impressions or mental residua. "These residua manifest themselves as so many *tendencies to recurrence*, and the larger the accumulation of them in any given form, the stronger that tendency becomes. Hence it is that men who are passionately devoted to any given branch of knowledge find food for observation everywhere. The botanist has an eye for a thousand minute plants which wholly escape the observation of the ordinary beholder; the entomologist has the same for insects; the geologist for the appearance of the soil, the rocks, and the mountains. Wherever long observation has accumulated vast stores of residua, the least stimulus will cause them to recur, and every fresh object will add something to the entire mass of our knowledge."*

In subsequent remarks on the *Culture of Language* several suggestions will be presented which are also exceedingly appropriate for exercising observation.

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* Morell's *Mental Philosophy*.

POWERS OF MENTAL REPRODUCTION.

LANGUAGE.

In considering the operations of the mind through the *Perceptive Faculties*, the necessity for the use of language does not become apparent. Sensations, perceptions, and conceptions may exist, impressions may be taken into the mind, and these may blend into ideas of objects, all without the aid of language. But we now come to a point, in the development of the human mind, where a new element is required; one which will enable the mind to embody its ideas in *signs* external to ourselves, so that it can safely store them away with the certainty of finding them again when wanted; and also of making them known to others. This element is supplied by *language*.

When the mind has blended its *residua* into simple ideas, and these simple ones have in turn combined into generalized forms, *language* comes in with its symbols, bringing order and fixity to our thoughts, and adding the power of using them at will. A single word may sum up the result of a vast series of individual impressions in a generalized form. Language aids in condensing and abbreviating our ideas. It thus acts in relation to our thoughts the part which algebraic symbols perform in higher mathematical calculations. As it would be impossible to keep all the parts of a complicated calculation in the mind without such symbols, so would it be beyond the possibility of mental power to retain and use our individual ideas without being overwhelmed with their in-

finite multiplicity, could we not sum them up in symbols, and use those symbols as representatives of certain mental equivalents.

Although we *perceive* the world by means of the senses, it is in and through the forms of language that we *comprehend* it. We are also brought into the general current of human thoughts through the agency of language; and by means of it we are enabled to remember and combine our ideas to an unlimited extent. Just as the symbols of numbers in algebra give us the power of calculating the most comprehensive and distant results, so the symbols of ideas in language enable us to combine our thoughts and work out our reasonings to an extent otherwise wholly unattainable.

The origin of language has long been a vexed question; but whether it sprung from the Divine Mind, and was communicated to Adam and Eve in the Garden of Eden; or whether, after the Creator had furnished man with all the necessary organs, and conferred on him the physical powers of speech, it developed itself in sounds as natural symbols of the mind's ideas of objects, which gradually took the form of *words* by common usage in representing the same things, and thus ultimately grew up from necessity into a means of communication between man and man, or not, this fact, at least, may be asserted of it—living language is in the process of daily creation. It is neither complete nor stationary. A dead language is a record of some past development of a race; a living language is the record of the present thoughts and mental progress of the nation, and of the individuals which use it.

Language furnishes the symbols of our ideas; hence it must change with the ideas of the people; and the extent of these changes is such that some words now symbolize ideas directly opposite in meaning to those which they once represented.

"Man's expressive power seems to have consummated itself in the phenomena of language. In this form his whole nature, animal, intellectual, and moral, finds effectual utterance; and by this instrumentality does he become pre-eminently a progressive being. Language is the channel in which the ceaseless stream of mental action flows onward to its great results. Without this outlet, his soul, imprisoned within itself, would stagnate, and its wondrous powers perish from inaction.

"As the medium of communication between mind and mind, language renders education practicable, and brings to the aid of the individual the accumulated thoughts of all time and of all men. Language is the peculiar and chosen province of education. Every process of human culture is conducted through its agency; every result attained in human progress is recorded in its terms; and in every civilized and cultivated community language is justly taken as the measure of individual and social attainment."*

The importance of language will be further considered when treating of Memory.

Culture in the Use of Language.—It has already been seen that our ideas are symbolized by means of words, and that language enables the mind to use its thoughts at will. It is now proper to present a few suggestions indicating how facility in the use of this simplest form of language may be acquired.

It is well known to those who observe infants during their early efforts at learning words that they first acquire the names of things, afterward names of acts, and of qualities. Since their commencement with language consists in learning words which are the names of external objects, great care should be taken to secure a correct understanding of these words, and a thorough symbolization of ideas by them.

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* From *Intellectual Education*, by Wm. Russell, A.M., in Barnard's *Journal of Education*.

The processes for aiding young children in learning this class of words is very plain. Either the things themselves may be shown them, and the words properly associated, or pictures can be employed to represent to the mind what cannot be directly made the subject of observation.

The following extracts are from *Language as a Means of Mental Culture*, by C. Marcel:

"From the moment that a child articulates distinctly, various familiar objects should be offered to his notice, and their use explained; their names being, at the same time, clearly uttered for him, he should be made to repeat them slowly and aloud. But he must not be forced into premature efforts to speak, lest he should acquire habits of indistinct and defective utterance. Premature walking is not more injurious to the organs of motion than is premature speaking to the vocal organs. In order also to guard against fatiguing him by a dry repetition of words, the instructor should enliven the exercise by making, in plain language and in a playful manner, some simple observations on the nature and use of the things which he is called upon to name.

"This exercise should at first be limited to a few objects at one time, and the same things should be repeatedly presented to him, associated with their names, until he perfectly knows these words. His vocabulary should be gradually extended by the introduction of new objects, which he is made to observe and name, such as articles of dress, food, furniture—everything which he can hold in his hand, or which may be seen either from the window or out-of-doors. This mode of proceeding will soon put a young child in possession of a large number of useful nouns.

"As the child's intellect opens and becomes capable of examining objects minutely, of distinguishing their resemblances and differences, of noticing their *parts*, their *matter*, their *color*, their *form*, and their *number*, his attention should be successively directed to all these points. Thus will his mind be early brought

in contact with the external world, and be duly exercised by ascribing to every object of sense its qualities and peculiar condition. He will also easily remember the words, when the ideas they signify are once clearly apprehended. A correct acquaintance with the meaning and application of words must not be deemed a matter of little moment in the first years of life. If we consider the disastrous results to which ignorance on these points has led, and the inconvenience which often arises to the best educated among us from this single source, we shall find that time well employed which is devoted to securing a knowledge of the meaning of words.

"The instructor should employ every means in his power to guard his pupils against using obscure terms, or words without definite ideas attached to them. To this effect objects and facts must not be brought under their notice in very rapid succession. The introduction of a new expression should be preceded by the perception of the thing signified, or the illustration of the fact which it serves to designate. They should, as it were, be made to feel the want of the word or expression. Then it will serve, as it ought, both to retain the impression and to recall it as occasion requires. By this means, also, their knowledge of words will keep pace with their ideas. Some people have more words than ideas; others have more ideas than words. Of these two evils, the second is the smaller; for we only find it an inconvenience not to be able adequately to express all our thoughts; but we render ourselves ridiculous by misapplying words for want of knowing their corresponding ideas.

"Children should be encouraged to state not only what they know, but what they can discover; they should indirectly be made to feel a wish for any information they require; they should be allowed frequent opportunities of asking questions and unfolding their own ideas; they should be desired to account for facts, to state the causes of the effects which they witness."

When the minds of children have become stimulated to such a degree as to lead them to be eager for information, do not repress this desire for knowledge by refusing

to answer, nor allow them to ask all the questions themselves. Frequently ply them with questions which will lead them to *tell* what they know of the objects that they see, and the sounds which they hear; and cause them also to gain ability to answer, by observing carefully those things about which the questions relate.

Request them to find resemblances and differences between two or more objects, and to name things which possess in common any given property, and others which have peculiar and distinct properties. Teach them to judge by their senses alone of distances in length, in height, or in depth; also of the dimensions, weights, and capacities of things. These trials of skill may be made objects of playful competition between children.

"As one of the chief objects of these lessons is to acquire a command of words, *young people should not be allowed to answer in monosyllables;* or, rather, questions should be put to them, so as to require more than a mere word of assent or dissent. A single yes, or no, often proceeds from a want of due consideration of the subject. Let them be encouraged to express their doubts freely on every subject, and the little discussions arising therefrom will be profitable, provided the confidence and vivacity with which they are carried on be tempered by modesty and courtesy. They will remove that awkward diffidence which, when not early counteracted, often proves an obstacle to success in after-life.

"These conversations are admirably calculated for inuring the young to mental labor, and preparing them for future exertion in every walk of science and literature. There is not a subject which could not, by easy transition, be entered upon, no information which could not be introduced. Things the most familiar, circumstances the most trivial, may give rise to instructive and interesting observations, and to the highest contemplations. Any object in the house, in the street, or in the fields, a toy—anything which is within reach, or within view—all that nature

has produced, or art has modified, can be made a subject of observation. The humblest as well as the noblest objects in creation may furnish inexhaustible topics of conversation, and lead, by a contemplation of the works of the Creator, to the manifestation of his infinite power, wisdom, and goodness.

"The abundance of matter in these lessons always affords the means of making instruction interesting to young people. Every new object which is submitted to their examination becomes valuable, not only because it exercises the mind and gives positive information, but also because the facts to which it leads are necessarily connected in their minds with similar facts previously ascertained. The more numerous the facts which children collect, the more will their judgment be rectified and invigorated, and the more clear and extensive will be their knowledge of words.

"These lessons cultivate in young people the talent of rational conversation, which, in ordinary education, is entirely left to chance, although it is the most useful, the most social, and the most intellectual of all talents. They impart the free, excursive acquaintance with various learning which makes the pleasing and instructive companion; and if they were generally adopted, they would not fail, in the course of time, to raise the tone of conversation in society. The powers of language of the learners being constantly called forth in proposing and answering questions, in stating the results of their observations, and in making verbal or written summaries of the subjects on which they have conversed, they will necessarily acquire great facility of expression in connection with great clearness of thought. And if they excel in conversation, they have every prospect of success in public speaking and writing.

"The variety of sensations and the pleasing action of the mental faculties throughout these animated lessons will, by arousing the creative powers of imagination, produce fertility of thought and aptitude for extempore speaking. Under the influence of the agreeable emotions arising from the contemplation of nature and the admiration of its wonders, the power of association in the young will retain that vividness and that freshness which are the life-springs of eloquence. The most beautiful images of ora-

tory are those which it borrows from the material realities of nature. The more diversified the instruction, the greater will be the number of ascertained facts, and the more extensive the command of language. Expressions and facts thus treasured up by the mind will remain ready for future use."

MEMORY.

Those mental operations by which ideas are produced have already been considered. Intimately connected with, and following these, appear a new class of mental manifestations—those exhibited in retaining and recalling ideas that have been previously acquired. The powers of the mind manifested by these processes are called *Memory.* Although we speak of memory as a faculty of the mind, we by no means regard it as a single mental power, but rather as a combination of several powers, the idea of which is represented by the term *memory.* The importance of this faculty is probably more generally appreciated than that of any other power belonging to the mind; yet *how* we remember, and what definite plans of instruction should be pursued to render memory the most serviceable to us, is very imperfectly understood.

The power of memory depends upon attention, and the order and system which we give to the arrangement of our ideas by classification and association through the aid of language.

"No one with any amount of attention could retain a perfect mental representation of the stars and groups of stars in the sky, were there no further mental activity exercised upon them than their mere perception. But let some principle of order and arrangement be brought in; let the groups be classified, and let the relative positions be marked by association; let the whole firmament be thus mapped out upon some intelligible principle, and there is a clew given by which the whole can be retained in the memory, and the separate portions at any time be recalled. And what is true here is equally true, according to its measure,

in every other case. *Nothing* that we see, hear, or think of *exists alone.* Everything stands in the midst of a system of ideas of which it forms a part, and with which it has numberless connections; and it is by surrounding a fact with a net-work of such ideas, all duly ordered and arranged, that we are enabled to go back to the exact point in the system where we shall be able to recover it, and bring it forth to our consciousness."*

Suppose we wish to remember a certain flower. By means of the perceptive faculties we examine it carefully, and locate the facts obtained in due order in some well-arranged system of botany. Then, in subsequent efforts, to recall those facts, as the mind passes along from the *class* to the *family*, and the *genus* and *species*, its characteristics readily recur to the memory.

It does not matter, so far as the principle of memory is concerned, whether the links which connect our ideas in a systematic arrangement be logical or practical, whether natural or artificial; *the important feature is order and system in blending, classifying, and associating our ideas.* However, it is very desirable, in cultivating the memory, to acquire habits of forming *natural* connections in associating ideas, since the links thus forged are stronger and of a wider use to the mind than those produced by artificial associations. Nevertheless, it is often necessary to create artificial links between our ideas, where very few natural ones exist. This is especially the case in the matter of dates and numbers. The whole principle of every system of *mnemonics* is based upon the plan of creating a connected series of artificial links to aid the memory, so that, when any one part of the series is given, the mind can pass by regular steps to any other, and thus drop down upon any particular number or date that may be required.

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* Morell's *Mental Philosophy.*

"The power of memory may be represented under the figure of a spider's web, which sends out its threads in all directions, establishing connection with every part, and with the central point of the whole. When the mind has woven such a web around any object, it can pass along any of the threads at pleasure, and reach any given point in the system. Thus, it only depends on *volition* to keep the clew to every idea we may desire to recall in our minds, and to bring it at any moment back into the light of consciousness."*

This view of memory gives an idea of the great importance of giving proper attention to its laws in methods of instruction. It shows us that if we would fix important truths and principles indelibly in the mind of a pupil, so that he can recall them at will, we must establish connections between them and *other ideas already existing in his mind.* First, a system of natural links should be established, since this process develops the most important power of memory. This may be accomplished through the blending of similar ideas into generalized forms, and then classifying and connecting these with kindred combinations of thought. Other connections may be made by means of practical associations; and still others by logical, and even by artificial, links, so that it will be impossible for the idea or truth to remain isolated in the mind. In this way the bridges will become so numerous that the mind can easily return to the truth thus lodged there at any future period.

Instead of this thorough discipline of the powers of memory in the school-room, and the development of these several aids to learning, the pupil is too commonly left to struggle on in vain efforts at the accumulation of knowledge by merely trying to "commit to memory" words which barely represent to him so many *isolated ideas.*

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* Morell's *Mental Philosophy.*

It is no wonder that neither the words nor the ideas which they symbolize are forth-coming when an examination is made to ascertain what the pupil has learned.

Importance of Language. — Notwithstanding the memory is so generally abused by committing mere words, it must not be inferred that words are of but little importance, and may therefore be slighted. Just the reverse is true. *Voluntary memory* is based upon language. Were our ideas not symbolized by words, or signs, we could not recall them at will. By means of language we can hold our ideas before us as something existing apart from ourselves, and combine, or separate, or place them in any relationship that we may choose. This is the highest order of memory. But, in cultivating the memory through the aid of language, care must be taken to secure the ideas which the words symbolize by means of classification, also by associating them with the words, and the words with the things represented. By these processes the mind may gain such a power as will render the memory both accurate and ready.

Association of ideas alone produces but an involuntary memory. Its peculiarity consists in the recalling of an idea by the presence of that with which it is associated, without the influence of the *will.* The sight of an object, a sound, an odor, a taste, or a feeling, may each recall ideas which have been previously associated with them; but the mind has not the power to recall at will, unaided by the presence of the associated object or quality, ideas that have not been symbolized with words or signs.

Human and Brute Memory.—Probably here is the dividing line between *human* memory and *brute* memory. The *human* memory deals with ideas, words, symbols, and even abstract ideas; and forms natural, artificial, and logical associations with these; and *is subject to the will.*

The *brute* memory deals with simple ideas and things only, and makes none but natural associations; and *the ideas are recalled by the presence of the associated object, without the influence of the will.* Human memory is *voluntary;* brute memory is *involuntary.*

The animal that learns to perform a certain act on hearing a given sound remembers the act by associating it with the sound. A horse that has travelled a road only once, when it again passes the same way recollects by association the places where it stopped, and even incidents that occurred. A dog that has been whipped for some act, associates the whipping with the act done, and thus is prevented from repeating it through this association.*

Man also uses this same process of memory—that of simple association; and, although it is a low order of development of this faculty, yet it is of great importance when properly exercised, and aided with ideas symbolized by words, and these words associated with objects. By this means, however, it becomes a very different process from that of direct association alone, and a most valuable aid in giving facility to memory.

Culture of Memory.—The powers of memory depend, to a great degree, upon the cultivation of those faculties by which knowledge is acquired. If the perceptive faculties be clear and active, the observation quick and accurate, the power of attention steady and strong, and habits of classifying and associating ideas carefully formed, the memory will firmly hold and readily reproduce the ideas and words which have been duly acquired. Therefore, by cultivating the powers of mental acquisition, the foundation for a retentive and ready memory will be laid.

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* An interesting chapter on the "Difference between Man and the Inferior Animals" may be found in Dr. Hooker's *Human Physiology*, p. 347.

Three Periods of Memory.—The memory assumes somewhat different aspects during the several periods of mental development. Because of these various conditions or tendencies of memory, it is especially important that the processes for its cultivation should correspond in character to its several stages of mental development.

First Period.—In infancy the memory is chiefly occupied with the simple materials furnished by the powers of mental acquisition—*ideas, and their symbols.* This period usually embraces about the *first eight or ten years* of the child's life. Since those powers of the mind which acquire ideas are earliest developed, and most active during the first period, children should then be chiefly trained in the attainment and memory of ideas and facts, and the words which represent them. But the words should always receive an immediately subsequent consideration, since their office is that of symbolizing the ideas so that they may be readily acted upon by the memory. During this period of acquisition *the order should be, first the idea, then the word as its sign.*

Young children should not be required to memorize words without having an idea of their meaning. It is true that their ideas must necessarily be less complete than those of adults, but they should be correct as far as they go, and such as the child's mind can grasp.

The exercise of the verbal memory merely is one of the great errors in the methods of school-room instruction, yet no method is more common than this in those primary schools where concert repetition is generally employed. The mere memorizing of words is allowed too prominent a place in the ordinary routine of schools, in comparison with its small educational value. The repetition of words is erroneously supposed to aid in cultivating the memory; whereas it may produce an opposite ef-

fect. Words continuously repeated, without associating them with ideas, may become so familiar to the ear, that, like the ticking of a clock in our room, they rarely attract the attention of the mind. When such is the condition, the repetition of words becomes not only a loss of time but a positive mental injury. If the habit of remembering words without understanding them be once formed, it will ever afterward prove a great obstacle to the successful acquisition of knowledge.

Some teachers make the great mistake, in school exercises, of treating this mental power as if it were the chief or only instrument by which knowledge is acquired and the mind cultivated. Acting upon this erroneous supposition, they require their pupils to "commit to memory" definitions, rules, formulas, problems, and demonstrations in grammar, arithmetic, and geometry, and pages of geography, and chapters of history, without understanding them, as if the repetition of these alone could work out the development of the mind by some mysterious transmutation. *Memory is not a faculty of mental acquisition*, but rather one of preserving and reproducing the knowledge which is accumulated through other faculties.

The suggestions given under the head of "Culture in Language" in the preceding pages will afford many useful hints relative to the cultivation of memory during this first period, as language and memory are intimately connected.

Second Period.—During the second period, which extends from the age of *eight* or *ten* to about *fifteen*, the memory is occupied more extensively with *language*, as the representative of *ideas embodied in connected thoughts.* Hence, this is the period especially adapted to the acquisition of the habit of "committing to memory" language that expresses thoughts accurately and beautifully.

The recollection of ideas is at all times of the greatest importance, but *the memory should be especially exercised on words and language during the second period of mental development.* While the ideas should still receive due attention, yet greater efforts may now be made toward forming habits of ready and accurate recollection of language. The importance of such a habit must be apparent to every one, when it is remembered how much more desirable it is to be able to repeat the exact statements of others instead of giving what we think were their ideas. If their words are given, every one may judge for himself what they mean; but if our own ideas of their meaning are given instead of their words, serious misunderstandings may be the result. Many instances have occurred in which grievous consequences have resulted from persons relating their own apprehensions of the meaning of others, instead of what they actually said.

During this period the work of instruction should be so conducted as to establish habits of readily committing to memory the thoughts of others; not only because at this time the mind is especially adapted to this exercise, but because, if neglected until the mind has attained that maturity and fixity of habits which are acquired during the third period, this habit of readiness and accuracy in the recollection of language probably will not be acquired at all.

Frequent "oral repetitions" aid the memory through the sense of *hearing*, by the associations of successive sounds, and may profitably be employed for this purpose *after* the ideas and language both have been taught to the children. While this is *one* of the processes which may be employed in committing to memory, yet it is the least intellectual of all, and should be used only to aid other and more intellectual modes.

Again, the importance of learning to remember lan-

guage will be understood, when it is considered that ideas fade from the memory much sooner when they are not associated with words. But it must not be inferred that the mere memory of words, without associating them with their ideas, will be of any educational service whatever.

By the practice of stating clearly in words what we wish to remember, the memory will obtain great power over our ideas. Without some such expression of thoughts in language, our ideas flow into each other so that they present no clearly-defined lines of thought by which we can recall them. This shows the importance of requiring pupils to express, partly at least, in their own words facts which we desire them to remember.

During this period special attention should be given to learning geography, history, biography; committing to memory declamations, poetry, quotations, and sentiments, as a means of storing the mind with gems of thought which are clothed in beautiful language, and also for contributing to a ready use of good language.

Third Period.—During the third period, commencing at about the age of fifteen, the memory begins to come more directly under the influence of the judgment, and to deal with reasons, principles, and laws—cause and effect. Yet neither ideas nor words should be neglected even then. In this stage of development a few words may be employed to represent many thoughts, and a short combination of words to imply trains of reasoning.

The habit of classifying ideas, and referring particular ones to general principles, will be found to greatly aid the memory during this period. Indeed, the power of memory depends for its strength and facility upon properly classifying and associating our ideas, and connecting them with other thoughts and facts previously acquired.

Employ as many of the senses in the acquisition of knowledge as possible, for each one will convey its peculiar form of impressions to the mind, and the blending of these together into ideas, the symbolizing of the ideas with words, and the classification and association of the words, furnish a great number of links by which the knowledge may be connected and recalled at will. If an object be examined by sight, then by touch, and the ideas which are thus gained of it be clearly stated in words, the mind will receive a third and new impression through the sense of hearing. Here, then, will be three distinct classes of impressions, derived by means of the senses of seeing, feeling, and hearing, to unite in forming a complete idea of the object, and also at the same time furnishing three classes of links by which it may be remembered.

In conclusion, let it be again impressed on the mind of teachers that the processes of instruction to be pursued should always be such that each subject and fact shall reach the mind through the greatest number of senses practicable; and especially *let the sense of sight be employed, when possible, in some form, to aid in securing clear conceptions;* and let a statement of the facts be clearly given in words, and associations be made with kindred facts previously acquired; then memory will be strong and ready, and progress in knowledge rapid and permanent.

ATTENTION.

ATTENTION is a mental phenomenon indicating a most important power of the mind. It does not, however, belong to that class of powers which are usually called faculties. Instead of acting by itself directly upon the world without through the senses, its mode of influence is by and through the other faculties. In its simplest state it appears to be merely *the notice which the mind takes of its sensations;* and frequently this attention seems to be involuntary. This is especially the case in very young children, when various objects are employed to attract the notice of the mind. But by degrees the mind exerts a greater and greater controlling influence over it, until attention finally becomes a *voluntary* act. In this capacity it is capable of being greatly strengthened by cultivation.

Of itself "it originates nothing, it teaches nothing, it puts us in possession of no new truth;" yet it is so intimately connected with the other mental powers that they would be of little avail without it. Thus we see that its importance can hardly be over-estimated, since the several faculties would become so deficient in the ability of continued action without it, that even natural acuteness could accomplish but little, and we should be destitute of those mental characteristics and steady habits which contribute so largely to success in life.

"The force of attention is simply the perceptiveness of the mind adjusting itself perfectly to the objects it contemplates, so that they may produce their full effect upon it. Until this adjustment is effected, the impression of the objects must necessari-

ly be confused and imperfect; as, in a camera-obscura, the lens must be placed in a proper position to receive all the light that comes from the landscape, or the picture will be blurred and indistinct. The mind cannot give its perceptive force to a multitude of objects at the same time; it can take up only one thing with effect at one instant."*

Attention is a bending of the mind to, or a stretching of it toward, an object. It enables the mind to arrest and detain the thoughts upon a particular object of interest, excluding for the time being other mental operations. It may become, for the moment, the sole occupation of the mind, as when we have heard a sound that greatly excites our interest, and listen for its repetition.

In order to make progress in intellectual culture, *habits of attention must be gained.* It is exceedingly important that these be acquired very early, because the utmost efficiency will be given to all the other operations of the mind by these habits, and especially to the acquisition of clear, impressive, and serviceable ideas. Attention should be associated with *volition* as early as possible; for when this power has become subject to the *will* the foundation is laid for every degree of mental culture which circumstances will permit.

Culture of Attention.—The habit of attention is an essential part of observation; therefore it must be acquired before progress in intellectual culture can be made. If we observe a child whose attention is absorbed with anything, we shall discover that sometimes it is *curiosity* that leads him to notice so carefully whatever may then be occupying the thoughts. At other times, or in different children, the simple *love of activity*, or desire to be constantly *doing* something, seems to be the leading motive. Again, we may notice that the child does not appear to

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* *Human Culture*, by Garvey.

be affected by either of the preceding influences, but by *sympathy*. Beside these, there is another power still which acts in producing attention; and although it may operate in conjunction with and through the influence of either of the motives already mentioned, it nevertheless is capable of controlling all the other influences; that power is the *will—the executive force of the mind*. Thus may we discover what the appropriate means to be employed in cultivating this important habit are, by observing the various influences acting upon the minds of children in producing attention.

Curiosity exists in every child, and it may be strongly excited by directing the attention to proper subjects, and imparting information in a manner suited to the child's capacity. The teacher who adapts instruction to the intelligence of his pupils, and interests their feelings, and changes the mode of presenting the object or the subject-matter, as the interest and the ability of the children to attend seem to indicate, will have no difficulty in securing their attention.

Love of Activity is another motive which sustains the attention, because activity affords pleasure to children. Physical activity is no more natural to the child than mental activity. That physical strength will not be acquired by a passive condition of the bodily organs is no more certain than that the mind can be strengthened only by its own activity. Physical and mental action should be combined in efforts to strengthen the attention. Various modes of doing this will be devised by the skilful teacher. As one mode of continuing the attention upon a given subject, the teacher might require the pupils to represent their ideas of it by actions, or by drawings, or in writing, and also to express them in language.

Sympathy is another strong incentive to attention; but it depends for its power upon the personal influence which the teacher has attained over the pupils through the exercise of the moral feelings. Where this personal ascendency exists, and the children see that the teacher is interested in the subject or work before them, they will make efforts not only to imitate her, but, from the happiness which is afforded them through sympathy, even to anticipate her desires and actions.

"There is nothing so likely to excite in children with whom we associate tastes for and attention to any subject as the exhibition of those tastes and habits in ourselves. Where the power of sympathy has been established, the idea that we are constantly occupied about them may excite the gratitude of children, but it will not determine the direction of their inclinations. Yet if they see that our interest is awakened and our curiosity excited by making some new observations, or by ascertaining some new fact, they will soon try to anticipate our discoveries. If they observe us interested in the cultivation of flowers, in watching the labors of the bee, or the metamorphoses of insects, or in admiring the beauties of a butterfly, or even *manifesting a lively interest in the exercises of the school*, they will soon be delighted with the same occupations. Example, emulation, curiosity, and sympathy —the most natural stimulants at this age, when pleasure is so vividly enjoyed, and the idea of utility so indistinct—act in unison in leading children to habits of attention."*

How immensely important, then, it becomes that every teacher should possess and manifest a genuine, hearty interest in the work of instruction!

We cannot secure that quality of attention which is necessary to success in education by mere outward compulsion. Hence the importance of understanding the several motives which have been previously described, and their influence in the formation of habits of atten-

* *Progressive Education*, by Madame Necker de Saussure.

tion; for whenever any constraint is necessary it should be exerted in conjunction with some one, at least, of these other influences.

It should be the aim of the teacher to bring the pupil's attention under the control of his *will* as early as possible. As this object is to be accomplished in connection with the habit of attention, time must be allowed for establishing it.

"The first efforts exacted from the child should be gentle; one point only should be presented at a time, that he may not be bewildered by multiplicity. The strain on his attention should not be long-continued; he should be relieved before he is compelled to desist from fatigue. One success will make a subsequent one easier of attainment; failure will make the next attempt more arduous.

"All children are not drawn alike to the same subject; some attend more readily to one, some to another. The teacher will find it advantageous to avail himself of these mental affinities in establishing the habit of attention in his pupils. The child should first be appealed to on those subjects, or on those aspects of a subject, to which he may incline. When he has learned attention to these, it will be less difficult to gain it for other subjects. The same progress in this habit must not be looked for from all pupils, and least of all within a given time. One who is of slow mental action may reach the mark much in arrear of his neighbor, who is of a more active temper of mind. Individual differences must be allowed for in the mental discipline of school."*

Among the obstacles to be overcome in the cultivation of habits of attention in a class of pupils are *slowness of mental action*, *sluggishness of temperament*, *timidity*, and undue *vivacity* or *volatility*. Slowness of mental action requires arousing by the stimulus of curiosity. But this may not prove sufficiently powerful for the sluggish tem-

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* *Principles and Practice of Common-School Education*, by James Currie, A.M., Principal of the Church of Scotland Training College, Edinburgh.

perament, which is in danger of slumbering on through all the lessons of school. Fortunately, however, it is very rare to find a child that is sluggish in everything; and *if he shows interest in even one thing more than in another, through that one avenue his mind may be reached, his sensibilities awakened, and his attention aroused to activity.*

If inattention arise from timidity, encouragement and gentleness are the proper means to be employed in stimulating the attention. The child that is inattentive from undue vivacity, restlessness, or volatility should receive sufficient individual attention to secure fixity of mind upon one subject for which he shows some fondness, by directing his attention to it again and again, and, if possible, by presenting a new feature of the subject on each successive occasion. The pupil should also be encouraged to perseverance and close application for a specified length of time, which, though quite short at first, may be gradually increased in length as the habits of attention become stronger.

The teacher with ready observation and good judgment will soon discover the leading mental qualities of his pupils, and for what things their preferences are shown; and he will seize upon those incentives which awaken the greatest activity of mind as the links which shall at length become united in fastening their attention upon other subjects. The success of efforts for cultivating attention may be read in the pupil's countenance, and this must be the index to guide the teacher in his labors.

IMAGINATION.

Among the different phenomena of the mind's activity we observe that it has the power of taking the elements of thought, which have been gathered by the conceptive faculty—*i. e.*, the concepts, or simple ideas—and recombining them into new images; also of separating or individualizing ideas of objects, already in its possession, into their distinctive peculiarities of form, color, size, taste, etc., so that each of these may form a distinct representation of its individualized feature. These distinctive peculiarities may be readily recombined with analogous features separated from other ideas, thus producing new mental creations.

The great mass of our ideas, in the keeping of the memory, are made up of many impressions or conceptions from objects; hence, are complex in their character. The mind has the power, not only of separating these complex ideas into their simple elements, but of recombining at will parts of the simple elements of many ideas into new images of the mind's own ideal creation. These powers of simple *analysis* and *synthesis* are called *imagination.*

It is a law of mind that *the imagination can deal only with ideas of sensible objects;* with concepts derived from something seen, or heard, or felt, or tasted, or smelled. *It has nothing to do with abstract ideas and truths, or with feelings wholly separated from sensible forms.* Whatever the imagination deals with it represents in such conditions, and clothes in such forms and colors, as come within the cognizance of the senses. Ideas derived from sen-

sible objects, therefore, constitute the groundwork of its operations.*

The imagination not only manifests itself in several forms, but in various degrees of power, in different individuals. The earliest form in which it exhibits itself is in children playing with their toys and dolls. The little boy builds houses, castles, bridges, and forts with his blocks. A stick becomes his horse; a bit of board, a boat or a carriage. The girl arrays her doll in all the finery and colors that her fancy can suggest; she converses with it, puts it asleep, feeds it, and administers imaginary medicines to relieve it of fancied pains. Indeed, the simplest objects, by trifling changes of shape and position, are made to represent various scenes in real life, by means of this faculty, thus throwing a sunlight of joy over childhood. The more the imagination of the child is brought into healthful exercise, the more pleasure he will derive from his plays.

But this active power of the mind, which is the source of so much pleasure to the child, may also become, through its abuse, the means of painful fears and mental suffering. It is through the excitability of this faculty that stories of monsters, ferocious animals, and phantoms, which are foolishly and cruelly told to children, fill their minds with terrors, and people darkness with imaginary dangers that cause unhappiness through their whole lives.

In childhood imagination exhibits most completely its objective form, and the ideal creations are commonly associated with objects that are present, as may be seen in the numerous little inventions of children; while in adults its operations are carried on chiefly with concepts and words, and it is manifested in the beautiful thoughts and ideal creations of the orator, the poet, and the artist;

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* Haven's *Mental Philosophy.*

while in its higher or philosophic forms it aids in classifying facts, and also deals with supposition, theory, and invention. It is exercised not only in the discoveries of science, but in the plans and projects of every-day life. *In the process of reasoning imagination goes beyond the known, and forms conceptions of something in the unknown, to which reason extends its powers of rigid examination.*

Memory is the mind's mirror, reflecting in its proper shape and color whatever has been before it. *Imagination is the mind's kaleidoscope;* it reflects what has been before it in a great variety of new forms and combinations.

Not only is the cultivation of the imagination almost totally neglected in the usual processes of education, but the power and facility which it gives the teacher, when properly used in imparting instruction, is singularly overlooked. Indeed, many consider this faculty as one which chiefly acts in the realms of fancy and fiction, and therefore regard it with suspicion. Such persons sometimes remark that "our children had better be occupied with something useful, instead of building air-castles." Pray, what *is* that which is useful to children? Activity, habits of attention, a love of knowledge, a mind stored with rich and sunny images which shall flit across it in after years, with all their pleasant associations. All these things are useful to children, and the province of a cultivated imagination is to aid in attaining them.

If we do not cultivate the imagination in such a manner that the child may delight itself in forming natural combinations and useful mental creations, the mind will run riot in folly and idle musings on scenes which can never be realized.

A story is related of Palonius, the celebrated Athenian painter, which illustrates the power of imagination. It is

said that Palonius once portrayed so vividly a group of sea-sick persons in the painting called the "Sea-sick Family," that landsmen could not look at it without experiencing nausea.

Culture of Imagination.—That language and pictorial illustrations are the two most available instruments in the culture of imagination may be known from the fact that children so readily become deeply interested in both. When language is employed in descriptions of absent objects and scenes so as to form *word-pictures*, it becomes a most attractive mode of instruction, because it furnishes opportunities for a lively exercise of the children's imaginations.

Simple lessons in geography afford excellent facilities for the use of language in the cultivation of this faculty, through descriptions of productions, occupations, climate, scenery, and animals of different countries. Children like to be transported in imagination to the cold scenes of the polar regions, or to the land of gorgeous flowers and luxuriant fruits, and to have thus pictured to them the occupations, manners, and costumes of the inhabitants of those foreign countries. And when these objects are associated with the countries to which they belong, the lesson becomes not only more interesting, but the instruction more vivid and lasting, because the associations will be such that it may be readily recalled. Biography and history furnish materials for similar exercises.

"The pleasure which young children derive from a narration of the simplest history is due to the liveliness of the pictures in their minds. The images which are conjured up within them are, perhaps, more brilliant and highly-wrought than real objects would be. There is no need of putting your invention to the rack in order to divert them. Take a child for the principal personage; join to it a cat, a dog, or horse—any combination, in

short, that makes an image; then relate your story with animation, and your infant auditor will so eagerly listen that the interest you excite will amount to a passion. Every time he meets you he will make you repeat your narrative. But beware of changing anything; for he wishes to see the same scene again, and the least circumstance omitted or added dissipates the illusion which pleased him."*

In the use of word-pictures in the processes of instruction the teacher should first present to the pupil a graphic outline of the most striking features of the scene, or object, before giving the minute characteristics. If the details be presented first, the mind is apt to become confused in the arrangement of these into the picture as a whole.

In illustration of one method of using word-pictures, let us suppose a person about to read the first twenty-three verses of the thirteenth chapter of Matthew. He might introduce the reading by saying:

"At the time when Jesus spake the words which I am about to read, he sat in a boat by the shore of the beautiful lake of Galilee, with its beach of fine white sand, and its cool and transparent water. On the narrow, fertile plain which rose gently above the lake were unfenced yet cultivated fields, across which lay foot-paths and the harder beaten road. Beyond were the hills lifting up their vine-clad sides, whose tops were crowned with olive-gardens, orange-groves, and citron and date trees. As Jesus sat in the boat, so near the shore that he could address the multitude standing there, he could also look upon the beautiful scene beyond, and he may have beheld a farmer sowing his seed on the newly-furrowed ground. Now listen to what Jesus said on that occasion:

"'Behold, a sower went forth to sow; and when he sowed,

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* *Progressive Education*, by Madame Necker de Saussure.

some seeds fell by the way side, and the fowls came and devoured them up: some fell upon stony places, where they had not much earth: and forthwith they sprung up, because they had no deepness of earth: and when the sun was up, they were scorched; and because they had no root, they withered away. And some fell among thorns; and the thorns sprung up, and choked them: but other fell into good ground, and brought forth fruit, some a hundredfold, some sixtyfold, some thirtyfold.' "

Let teachers accustom themselves to drawing truthful word-pictures, and the impressions made on the minds of their pupils will be life-long.

As a practical mode of using pictorial illustrations in the culture of imagination, take some appropriate picture and describe it while holding its back toward the pupils; then show it to them, and invite them to point out all the features that were mentioned in the description. Afterward request them to point out the prominent features, and describe the picture while looking at it. Subsequently require them to describe the same picture from memory.

Playthings of the child's own arrangement or invention afford him more amusement than the most costly toys. No better playthings can be given to a boy from two to four years of age than a box of inch cubes, or one of brick-shaped blocks, each about four inches long, two wide, and one inch in thickness. With these cubes, or the brick-blocks, he can exercise his imagination, and acquire much useful skill, by arranging them in a great variety of forms and positions to represent his own ideal creations.

It is the exercise of the faculty of imagination, chiefly, which causes children to be so fond of playing with water, mud, or sand, because with these substances they can construct representations of such objects as are used by men and women in the avocations of life.

"The entire existence of little children is dramatic. Their life is a pleasing dream, prolonged and supported by design. Incessantly inventing, adorning, and acting scenes, their days pass away in fiction; and, but for their puerility, they would be poets. In truth, all that poets have sung, all that mythology has consecrated, all that superstition has fancied of the life which is spread throughout Nature's works, is found in lively traits—sometimes burlesque, indeed—in early childhood."*

When the imagination has become excited through fears awakened by cruel suggestions and bugbear stories, the most careful management is necessary to remove the evil. It is of little use to combat directly the chimeras of the imagination. Reasoning will prove of little utility in removing these imaginary fears; for although we may succeed in convincing the child that there is no real danger, yet the imagination is so strong that the vision of the supposed danger will still retain its influence. Better plans for removing such fear are to leave the predominant thought to be forgotten, to expel the sensation by a stronger one, to divert the attention, to interest and cultivate the moral and physical nature. A most direct remedy is to substitute, by the presence of the real object in the child's mind, the image of the formidable object in place of the imaginary creation. What we really see, although it be repulsive or disagreeable, produces a tranquillizing effect upon the senses, and thus removes fears. When this course is expedient, it is very efficacious; but it should be pursued with judgment.

Fables, riddles, conundrums, puzzles, etc., furnish means for exercising this faculty. What child does not like to listen to good fables over and over again, such as "The Fox and the Grapes," "The Dog and his Shadow," "The Dog and the Manger," "The Shepherd-boy and the Wolf," or "The Fox and the Crow?" Such fables and

* *Progressive Education*, by Madame Necker de Saussure.

tales as contain instruction, and impart moral truths, should be selected and related to children in whom we desire to cultivate imagination. This will be found a favorable mode of imparting to children practical wisdom when other means fail.

The exercise of this faculty in its higher forms is intimately connected with *taste*, and with that philosophical process of the mind's operations which leads to conceptions of general truths, and with generalizations. In the department of taste imagination is cultivated by "the study of the ideal creations of others, especially of those highly gifted minds which have adorned and enriched their age with productions of rarest value—poetry, painting, sculpture, or architecture—which bear the stamp and seal of immortality. With these, in whatever department of letters or art—in poetry, oratory, music, painting, sculpture, architecture—whatever is grand and lofty, and full of inspiration, whatever is beautiful and pleasing, whatever is of choicest worth and excellence in its own proper sphere; with these, I repeat, let him become familiar who seeks to cultivate the faculty of the ideal. Every work of the imagination appeals to the imagination of the observer, and thus develops the faculty which it calls into exercise. No one can be familiar with the creations of Shakspeare and Milton, of Mozart and Beethoven, of Raphael and Michael Angelo, and not catch something of their inspiration."*

The study of Nature in her various moods of sublimity, grandeur, and beauty, is the most successful mode of developing the highest powers of this faculty. The science of astronomy furnishes an excellent means of exercising the imagination in a manner that will strengthen the intellectual and moral powers, and prevent the development of those fictitious fancies which, while they can never be realized, tend to weaken these powers, and to create a dislike for science and the realities of life.

* Haven's *Mental Philosophy*.

POWERS OF HUMAN REASON.

COMPARISON.

"There is a law of mind, operating from the very earliest period of our conscious being, by virtue of which identical and similar residua blend together, so that one single mental image is formed out of the whole."*

In observing a number of objects of the same class we at once become conscious of general *similarities* which run through the whole; and we also observe, at the same time, a great variety of *dissimilarities* between one individual and another. Now, each individual object leaves its own special mental residuum in the mind, so that we unconsciously accumulate a large number of impressions which have a family likeness. All these residua, *so far as they resemble each other*, blend together; while the remaining elements in the residua, which are unlike, are left free to combine with any other impressions with which they may have any special affinity. Thus, in the development of concepts there is a latent process of classification always going on.

In observing the operations of this law it is found that, in proportion to the greater similarity of the objects, the tendency in the corresponding residua to blend together will be greater. It is because of the existence of this mental law that we find it so difficult to count any number of precisely similar objects, as a flock of sheep, a number of marbles, or a row of fence-pickets. The perception of each individual thing is clear enough, but the

* Morell's *Mental Philosophy.*

residuum it leaves in the mind so instantly blends with the residuum of the others that we cannot keep them apart; hence confusion in our reckoning is the result.

Now, not only do like residua blend together in the formation of concepts, or simple ideas, but simple ideas also combine into generalized ideas, as has already been described in treating of the formation of ideas.*

In these earliest processes of the mind's operations we observe the development of its recognition of *likeness* and *unlikeness* of things, and the law by which classification and generalization exist. From the continued exercise of these processes of classification there at length grows up the habit of a more general comparison of objects, and of ideas, for the discovery of their resemblances and differences. Here, then, we see the mode of development, and the nature of that mental operation which is commonly known as *Comparison*. *In its operations during infancy, comparison considers the resemblances of only two objects, both of which are present;* subsequently it considers the present with the remembered absent. It is the child's first step toward judgment, and forms a part of the process of reasoning. Comparison deals with two opposite qualities — resemblance and difference. The mind first takes cognizance of resemblances, then of differences; therefore in the processes of early education this order should be observed.

Culture of Comparison.—We have already seen that the *law of similarity*, on which comparison is founded, exists in the mind before any educational processes can be applied to shape it; yet habits of ready and accurate discrimination of resemblances and differences are to a great extent the result of education. These habits of comparison may be acquired by means of appropriate ex-

* See page 360, "How Ideas are Formed."

ercises. In supplying the necessary means for this purpose the familiar objects of nature should first claim our attention, and their physical parts and properties be considered earlier than their abstract qualities.

"The child's earliest perceptions being those of color, form, size, and motion, given him by sight, he should be led to notice the resemblance of one object to another, whole to whole, in respect to these perceptions." Thus, the dog is set beside the cat, the sheep beside the goat, the horse beside the ox, the cat with the lion, the hen with the turkey, the duck with the goose, the apple with the orange, the rose with the pink, the grape with the plum; while comparisons are made in respect to form, color, size, manner of motion, etc. The covering of the sheep may be compared with that of the dog, the overlapping feathers of birds with the shingles or tiles on a roof.

Subsequently this process of comparison may be extended to objects of which one is absent and inaccessible; thus, it becomes the means of enabling the imagination to form conceptions of things beyond the range of our senses. In this manner the formation of the claw of the tiger may be understood from comparison with that of the cat; the contour and characteristics of a wolf from those of a dog; and, by resemblances and differences combined, the beak and claws of the hawk or eagle may be conceived from those of the hen or the canary; the covering of the Brazil-nut from the common walnut. Indeed, the field is boundless, and the subjects are numberless, for the exercise of comparison and the acquisition of knowledge through its aid.

"Somewhat later, more abstruse conceptions of the qualities of bodies revealed by sight, and those which touch makes known, become the subjects of comparison, as when the transparency of

glass suggests the transparency of the atmosphere or of water; or the porosity of a sponge is exhibited in different degrees, as in sugar and wood; or the elasticity of a steel-spring is found to exist in india-rubber and in air. These resemblances, being such as would never occur to the child himself, require to be verified by observation, and the more unexpected they are to him, the more valuable are they as a process of education, because more stimulating to the senses.

"Besides natural objects, and their parts and qualities, there is another department of the child's instruction very fertile in materials for the exercise of comparison, viz., form. Thus the line, singly and in its various combinations, may be made to figure in his mind as the pencil, pen, cross, star, arrow, letters of the alphabet; the rectilineal figures, as table, box, window-frame, door, book, or slate; the curved figures, as plate, hoop, bell, egg, or cup; and the geometrical solids which the teacher submits to his observation become common things in his eyes, when exemplified, as orange, turnip, beet, ball, brick, pillar, arch, turret, church-spire, or box.

"The idea of likeness involves that of its opposite, unlikeness. Comparison is equally cultivated by being directed to both. Wherever we can institute comparison between objects of any kind, we can institute contrast, and the teacher will often find contrast the more impressive, and the more effective for carrying out the educational maxim—'*Teach the unknown by the known.*' But to render this maxim valuable the mode of procedure must be the child's, and not merely that of the teacher. It is for the teacher so to present the objects of comparison that the resemblance or contrast which he aims at eliciting shall spring up in the child's mind in response to his hints, suggestions, and questions."*

"When the child's perceptive faculties have been exercised on the most apparent properties of things, and when he has learned to confine and prolong his attention, he should be required to examine objects more minutely, to compare them under different

* Currie's *Principles and Practice of Education.*

points of view, and to state in what particular two or more resemble or differ. These exercises would prove highly interesting to young people, who delight in discovering differences in similar things, and resemblances between different things. He who is best able to compare will know best how to analyze, to abstract, to generalize, to classify, to judge—in one word, to reason.

"As young persons collect facts, they must be frequently exercised in classifying them with reference to their resemblance or difference. If any number of objects is considered with regard to one or several points of resemblance, the collection constitutes a class named *genus;* subdivisions of these into classes of objects having properties in common and distinct from the rest, form as many *species;* finally, when, on a closer examination, single objects are considered in reference to properties which are peculiar to them, they are denominated *individuals.* The pupil should be shown that the terms *genus* and *species* are relative. For example, *bird* is a *genus; eagle* is a *species. Affection* is a *genus*, while *filial love* is a *species.* The distinction of generic and specific terms applies to a very extensive range of mental conceptions.

"*The complex operation of classifying things according to their points of resemblance, and of distinguishing them by their points of dissimilarity, is one of the highest exercises of our reason and the most admirable effect of analysis.* It will develop in a child the powers of observation, abstraction, and generalization, and will prepare him for the study of the natural and experimental sciences, by giving him habits of inductive reasoning—a principle on which these sciences rest. *Comparison and classification are the complements of observation, and the groundwork of inductive philosophy, and of all scientific investigation.*"*

Analogy.—By extending comparison to the consideration of resemblances in *relations* it assumes a form commonly known as analogy. It now involves four terms in its comparisons, and its exercise belongs to a later development of the mind than simple comparison of objects and qualities, in which only two terms are considered.

* Marcel's *Language and Mental Culture.*

In analogy the relation of the trunk to the tree is compared with the relation of the body to the man; the circulation of the sap in the tree, to the circulation of blood in the animal; the sting of a bee and the prickles of the hedge-hog, as a means of defence.

In combination with language and imagination, comparison leads to the formation of similies, emblems, parables, proverbs, and figurative terms. Some of these will be readily recognized in the "laughing brook," the "blushing morn," the "whisper of the breeze," and similar phrases.

Judgment.—During the exercises of comparison and classification the mind is constantly forming decisions as to the likeness and unlikeness, resemblances and differences of objects and qualities; and these decisions are called *judgments*. They are the simple results of *comparison*, and constitute an important part of the process of classification. These simple judgments, accumulating by means of observation and comparison, combine to make up our certain and valuable knowledge of things.

By this exercise of considering various things with reference to each other there is laid a foundation for accuracy in discrimination and soundness of judgment, which forms that character of mind known as a *good understanding*. The power of comparison, distinguishing and judging between two or more things, is generally implied by the term "understanding." To understand a thing is to know its proper connections in nature and art, and to see it in combination with everything else of a cognate character. It will, therefore, readily be perceived that accuracy of judgment must depend upon habits of correct observation. Here we see again the great importance of thoroughly training the *Powers of Mental Acquisition;* for, unless these be properly cultivated, much of the labor

bestowed upon the other powers of the mind will be in vain, and it will be impossible to attain accuracy in reasoning.

There is, however, that higher form of mental activity, which determines the result of reasoning, that is called judgment. This term is also applied to the final decisions of the mind, attained through the process of reasoning. The mental activity, known as judgment and its processes, is so intimately connected with the operations of other mental powers, and their special educational influences are so inseparable, that it will not be profitable to dwell longer on the separate consideration of judgment in this connection.

REASON.

THE exercise of *comparison* and *judgment*, in the discriminating processes of classification, gives definiteness and exactness to the habits of observation, and thus tends to produce certainty in our knowledge. But there appears to be a still higher mental power, which enables the mind to search deeply and scrutinize closely even the obscure and uncertain or doubtful in our mental accumulations, till everything is brought into light, the false separated from the true, and our conscious knowledge rendered positive. This highest mental power is called *reason.* This power of the mind differs from all others in its capacity for dealing with a multiplicity of objects and ideas at once, and drawing general results out of a whole.

Reasoning is a mental process by which unknown truths are determined, or learned, by means of those that are known. We see some things to be true in consequence of having seen some other things to be true. This mode of seeing is called *reasoning.* If we observe what the mind does—what its successive acts are when it sees a thing to be true because it has previously seen another thing to be true—we shall observe the process of reasoning.*

For an illustration: suppose I hear a piano in a house as I pass along the street. I hear its sounds. I remember that I have heard similar sounds, and that they were caused by a piano. I infer immediately that there is a piano in the house. The sounds, and the remembrance

* Alden's *Elements of Intellectual Philosophy.*

of similar sounds and their causes, are the *known* truths; that there is a piano in the house which I am passing is the unknown truth which I determine to be true from the known.

Again, suppose I observe dilapidated walls and the charred remains of timber. I infer that a building has been destroyed by fire. The facts perceived and *known* are the crumbling walls and charred remains, and the recollection of the effects of fires previously known. From these facts I infer that the present ruins were caused by fire—thus determining the unknown from the known.

Mathematical reasoning is a process by which the mind determines unknown mathematical truths by means of those that are known. *Mathematical reasoning* places no reliance on testimony; all the terms are exactly defined and limited. There is no possible ground of misapprehension. Each truth is proved beyond all possible question, or it is not proved at all. No possible room exists for a doubt in the final result, which is as certain as the first. If the operation be accurate, the result of a problem requiring a million of figures is as certain as that of one requiring but two.

Moral reasoning deals with things in the concrete. It places reliance upon testimony. Its proofs have respect to matters and events as they actually are or have been.

To be a good reasoner a person must possess *an accurate perception of the relations of things;* also *a habit of fixed and patient attention*, and *a mind well stored with knowledge.*

In exercising our reason we hold many threads of ideas, and bring them all into one centre, so as to determine the true result. Reason draws every mental and bodily power into its service in directing the course of human action.

It governs the motives and thoughts and actions of man, and prompts him to provide for his own sustenance and happiness.

Reason gives rise to law, government, jurisprudence, and social science, when applied to the necessities and wants of society, in determining and adjusting the relations of property and the actions of men in reference to each other. In science we see the human reason in its more mature form investigating nature, prying into its elements, interpreting its laws, and then making all subservient to the wants of mankind.

"We are not only surrounded by elements of nature, which we adapt to our personal wants and conveniences, but by forms of infinite beauty, by a universe which displays the most elaborate care and design, by a world, too, of human action; and to these objective facts and realities the mind has respondent thoughts, emotions, sympathies, and desires. Reason, then, has once more to resume its task, and show us how to adapt our life—the higher life of the soul—to this environment of Divine beneficence and human brotherhood. Morality and religion are essential to the full bloom of the human mind and the highest form of society; and it is the reason which again in this highest sense helps to adjust the relations between the actions and habits of man, and the moral universe in the midst of which he is placed."*

The extent to which reason is developed in any given case is measured by the number and the remoteness of the relations which can be grasped at one single view, or the number of ideas that can be dealt with at once, in determining a result. The savage can show great acuteness and cunning in dealing with a few simple relations, but beyond this capability he becomes completely baffled. The Indian can plan a secret attack upon his enemy; but the attempt to grasp the strategical relations of a modern

* Morell's *Mental Philosophy*.

battle lies entirely beyond his reach. Thus it is in every case, the remoteness of the means toward securing any given end is an almost perfect measure of the power of the reason which grasps and applies them.

Reason may justly be called the *truth-organ** of the human mind, the guide and director of human activity. Truth is but a just apprehension of the relations of things in this universe to which we belong. It is by this faculty that these relations, in all their complexity, can be known or apprehended, and the great law of intelligence exhibited in its highest form.

The ordinary investigator is satisfied when he can find an answer to the question, *What is it?* He is contented when told that *it is so and so.* But it is different with the philosopher. When this question is answered, he has another to put: *How is it so and so?* He is not satisfied with knowing the *what*, he must also know the *how.* That power of the mind which furnishes the answer to the question, *How is it?* is called *reason.* It is the most far-ranging and the loftiest of all our intellectual powers. It enables us, from visible effects, to go back to the causes of these effects, into a distant past; and from causes now in operation to anticipate the effects of these causes in a distant future.†

Cultivation of Reason.—As soon as the child begins to observe and to think, his first steps toward reasoning are taken. But in this early stage the process of the mind is that of observing resemblances, and dealing only with present objects and present acts. *The reasoning of children consists chiefly in making simple deductions or inferences from palpable facts, or from the comparison of two objects, one or both being present.*

In this concrete form reason is exercised by children

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* Morell. † McCosh's *Typical Forms.*

from *five to ten* years of age. They will make their inferences from sounds, language, and actions, as well as from objects. They can readily perceive the resemblances between two or three objects, but their minds can hardly grasp anything beyond the simplest relations, at this period. Hence *care should be taken by the teacher not to overwhelm the young pupils*, while giving object-lessons, *with numerous comparisons* and *scientific classifications*, lest the terms or words employed remain but little more than unmeaning sounds to their minds. During the period preceding the age of ten years, the exercises for the cultivation of the child's mind must deal with realities, objects, actions, qualities, and simple relations; not with the abstract, or those thoughts that require mature judgment and the higher powers of reason to comprehend. The methods of teaching should employ chiefly the perceptive and observing powers of the mind.

Remarks under the head of *Comparison* will furnish suggestions for developing these simple powers of reason during childhood.

Reasoning in its higher forms investigates the relations of abstract ideas, dealing with facts established by experience and observation. The reflective faculties are chiefly active in its operations. The period from twelve to fifteen years of age usually is the appropriate time for *beginning* to train the power of reason in its higher forms. Then the formation of habits of methodic thinking and systematic comparisons should be commenced. Whatever will add clearness, directness, conciseness, and a natural order to the habits of thinking and speaking, of readily perceiving and inferring all the relations of a subject, and deriving therefrom the proper conclusions, will strengthen the power of reasoning. One cannot get skill in reasoning by studying rules which pretend to teach it.

"Men learn to reason by reasoning, and not by the study of treatises on logic. * * * Logic, as taught in the schools, does not profess to teach one how to reason. It professes to teach him how to cast an argument into a syllogistic form, in order that its soundness or unsoundness may appear from the form of the syllogism, though the argument were not understood. * * * If reasoning consists in perceiving certain relations existing between truths, the power of cognizing relations should be exercised in preference to the practice of formal rules.

"We learn to reason by reasoning, just as we learn to remember by remembering. Let the student select the best specimens of reasoning to be found in the language. Let him make those specimens the subject of a careful study. Let him note how such men as Marshall and Webster and other great reasoners reasoned, and let him go and do likewise.

"The study of mathematics may form habits favorable to moral reasoning, but cannot make a moral reasoner; that is, cannot make one skilful in reasoning on subjects that are not mathematical. The exclusive devotion of the mind for a long time to mathematical reasoning has a tendency to unfit one for moral reasoning. The mind forms the habit of demanding certainty at every step, and acquires no skill in weighing probabilities, and evolving the truth from conflicting evidences. To estimate probabilities, and to reconcile apparent contradictions, and to detect tendencies, are processes which the reasoner on practical matters has occasion to perform daily; and he who acquires skill in these processes is better fitted for practical life than he who has skill in the use of the calculus."*

Mathematics have too generally been considered the most important branch of instruction for cultivating the reasoning power of the mind. On this subject Sir William Hamilton says that—

"Mathematics are not adapted to produce the effect so commonly ascribed to them, since they treat of nothing but quantity;

* Alden's *Elements of Intellectual Philosophy.*

whereas, in the other sciences, and in the affairs of life, we are required to deal with the relations of facts in connection with philosophy, natural history, and language."

The following, from "Notes to Locke's *Conduct of the Understanding*," by Thomas Fowler, of Oxford University, is important testimony in relation to the matter of the cultivation of reason:

"To cultivate habits of precise reasoning, and to train the mind to deal with abstract ideas and principles, no discipline can be better than that of mathematics. But a mind trained exclusively on mathematics would be ill-equipped to deal with the various and complicated problems of life and science. An early training in mathematical reasoning should always be supplemented, as education proceeds, by forming a habit of analyzing and estimating the value of evidence in subjects which admit not only of certain, but of more or less probable, conclusions, such as language, law, the moral and physical sciences, history, and the affairs of ordinary life."

POWERS OF MORAL ACTION.

THE FEELINGS, SENTIMENTS, AND EMOTIONS.

Among the numerous acts performed by the human mind, of which every one is conscious, are those which are known by the terms *perceiving*, *remembering*, *imagining*, and *reasoning*. These operations of the mind all belong to the *intellectual powers*. There is also another class of actions by the human mind, equally apparent to the consciousness of every one, which are known as the *feelings*, and include the *sentiments* of *benevolence*, *veneration*, *justice*, *self-esteem;* also the *emotions* of *love*, *affection*, *hope*, *fear*, *sorrow*, *happiness*, *desire*, *anger*, etc. It is just as much the nature of the human mind to exercise the feelings as it is to exercise the intellectual powers.

The mind has power to perceive right and wrong, love, hatred, desire, hope, sorrow, and justice, as well as form, number, size, weight, color, sound, odors, and flavors. The mind's acts in the former sphere are called its *moral powers;* its acts in the latter sphere are known as its *intellectual powers*. When the mind attends to the knowledge of things and truths in physical science, its intellectual powers are exercised; when it attends to the knowledge of the actions of men, perceiving the right and wrong in them—truth and error—its moral powers are exercised.

Conscience is the name generally applied to the mind's power of distinguishing good from evil, right

from wrong, in human actions. But this idea is not entirely satisfactory, as it appears to give too much of an intellectual character to this power, instead of placing it as *a moral light that leads us to see our motives of moral action, and tell us whether these motives are right or wrong.*

Conscience is to the moral sphere what consciousness is to the intellectual sphere. One cognizes truth in the moral world, the other truth in the physical world. Conscience, however, is not so much a distinct faculty as it is the condition of all the moral powers.

It is through the exercise of the moral powers that man recognizes his relation and duties to God—love, reverence, and obedience—and accepts the Divine command, "Thou shalt love the Lord thy God with all thy heart, and with all thy soul, and with all thy mind, and with all thy strength."

It is through the exercise of these powers that man recognizes his relation and duties to his neighbor—benevolence, justice, and sincerity—and the great principles for moral action taught in "Thou shalt love thy neighbor as thyself," and "Whatsoever ye would that men should do to you, do ye even so to them."

Language is largely composed of words which symbolize ideas that belong to the feelings and emotions. It is the business of moral education to strengthen the powers of perceiving truths and duties. Moral education is that training which leads to the permanent possession of right feelings, and to the performance of right actions.

TRAINING THE MORAL POWERS.

"Train up a child in the way he should go," is a command of supreme authority. In obeying this, both parent and teacher will cultivate the moral powers of children that come under their instruction. This work should be

commenced very early, because the emotions are active and tender in childhood. The first six years embrace the most critical and important period in moral training; and the moral impressions received during the first ten years usually determine the future moral character. The disposition and character may not be completely formed during this period, but its inclinations and tendencies will have become so strong that it would require more than fourfold the power to change them that it took to form them.

Means of Training the Feelings.—"*The chief means of training the feelings consists in drawing them out into action;* we may say, the only means. A feeling apart from its corresponding activity is a mere sentiment; a thing of which our neighbors are not conscious, which does nothing, and which practically is nothing. Activity is natural to the child in its moral character, just as we have seen it to be in its physical and mental. A child, in the presence of kindness and affection, exhibits a sympathy with it, or a return of it by something which it does. In the presence of pain, it tries its little to relieve it. We must therefore provide him with the means of acting out right feelings; and we must weaken by non-activity those of an opposite character.

"If we would cultivate kindness in a child let us show kindness in our deeds, and he will return kind deeds; if reverence, let us habitually show the example of reverence, and he will conform; if justice, honesty, truthfulness, we must arrange the little society of the child so that in the daily intercourse he will have opportunities of seeing and of exemplifying them.

"If kindness, reverence, justice, honesty, and truthfulness be nerve *acted* before the child, then, however much these may be spoken about, he will have no sense of their obligation. It is only as acts that the child can know them; in themselves they are abstract terms of which he can form no conception. So, if we wish to root out improper feelings, or to prevent their growth, such as vanity or the love of praise, rivalry or the love of superiority, we must withhold the praise which ministers to these feelings. The law of exercise is of universal application in

education; and it needs to be specially insisted on in moral training.

"In view of this law the school offers a very wide field for moral training. There is great room for activity of all sorts. The children are in constant contact with their superiors in the person of the teacher; with their equals in the persons of their comrades; they are under direct superintendence in the school-room, and allowed greater freedom on the play-ground. In the different occupations and the separate interests of the little society, all the feelings which relate to their neighbors have room to show themselves; while the feelings that relate to things—honesty, order, cleanliness, and diligence—are also exercised.

"Provided the law of exercise be observed, provided the children be accustomed to associate immediate action with the feelings called up by the scenes which occur daily amongst themselves, the teacher may avail herself of the power which imagination gives her of multiplying indefinitely, both in number and in character, these scenes of represented feeling. The moral use of the *imagination* is to enable us to enter into the feelings of others by drawing a mental picture of their circumstances. At a scene of virtue or heroism a child will feel pleasure, and manifest approval; at a scene of suffering or wickedness he will feel pain, and manifest disapproval. His moral instruction goes on in great part through the medium of this exercise of imagination; for it leaves him images of good which recur to him, and with which he may compare himself. At the same time we must beware of making this pass for the whole of his moral training. *Moral action* must not be superseded by this.

"Moral training must be viewed as a positive, not as a negative process. *A system of prohibitions will not inspire one good impulse.* This manner of educating, though very common, because very easy, is in every way deficient. In the first place, we have not the means of repressing faults in the child so easily as of encouraging good dispositions. These prohibitions are an insufficient barrier in the hour of trial; too often they are swept away at the approach of evil. They can never meet the exigencies of the case. We may have prohibitions for many wrong actions,

but we cannot for all. But a positive principle is far-reaching in its influence. *One good disposition imbibed will strangle ten forms of vice.* A child may annoy his companion in many ways; he may strike him, or call him names, or keep others from associating with him, or tell tales of him, or ridicule him. The possession of a controlling feeling of *kindness*, of a permanent desire of doing to others as you would have others do to you, would banish all of these annoyances. We must *exhibit what is right for imitation*, rather than what is wrong for warning. Vice should be checked; but it is best done on its actual occurrence. The frequent portraying of it has a bad effect on the tone of the feelings, often suggesting the consciousness of vices to which the mind has hitherto been a stranger.

"Before asking children to show generosity we should have previously associated pleasure in their minds with this manner of acting, in which case their desires will correspond with our wish. *Great care should be taken neither to place nor leave temptations in the way of children*, as is sometimes done in the course of instruction, by putting questions in such a way that the child must admit itself guilty of a fault, or of some negligence, or utter an untruth. Few can withstand this kind of temptation."

Truthfulness.—"Of the duties that flow from our social relations, truthfulness claims to be first mentioned; that sincerity by which men know that what we profess to think, say, or do, is what we really think, say, or do. *Truthfulness, as a steady principle, does not seem to be of spontaneous growth in the child.* He does not of himself see the necessity of giving exact representations of the past and future for their own sakes. Living in the present, he sees nothing in the facts which come before him that should prevent him from coloring them after his own fancy.

"Truthfulness is the virtue of widest application; fortunately, it is also that for the cultivation of which there is the most constant opportunity, as the child comes in contact with his own comrades, his teacher, and parents. *To train a child in habits of truthfulness, be truthful with him;* say nothing that is not literally true; make no exaggerations; *leave no promises unfulfilled;*

remember all the expectations that you may have led him to entertain; remember that even a single instance of untruth in yourself may unsettle his perception of the obligation of truthfulness. Enforce the performance of every promise; reward his confessions, as far as you may, with forgiveness.

"Treat all with confidence till you have detected one deceiving you, and then restore not that one to your confidence till in the eyes of all of his associates he has deserved it. Show the pain and surprise felt at a breach of trust. Treat all the little ones habitually with kindness and frankness, and thus *banish fear, the parent of many lies.* Lead them not into temptation. In speaking of honesty, do not ask a child before a class whether he has ever taken anything from his father or mother, or brother or sister, without their approval or consent. In treating of kindness, do not ask him to tell whether he has always been obedient and kind to his mother, and agreeable and kind to his sister. Such questions are snares for the conscience, and offer temptations to untruthfulness that can hardly be resisted."

Kindness.—"Next to truthfulness may be mentioned benevolence or kindness; that feeling, the opposite of selfishness, which leads us to think of and sympathize with the feelings of others. A great deal of unkindness amongst children arises not so much from deliberate intention, as from thoughtlessness. The crowning test of kindness of feeling is the display of self-denial to oblige our neighbor.

"This is illustrated in the case of a little boy that came to school one day without his lunch; and when the rest were eating theirs at play-time, he had none. The teacher divided her lunch, and called one of the pupils to deliver a part of it to the fasting one, which he did gladly, as it called for no sacrifice. He felt satisfaction at seeing the want of his comrade relieved. This satisfaction was heightened by the pleasure felt and expressed by the teacher. Not long after, the same pupil was observed quietly performing a similar act of generosity to another companion, at his own expense. The teacher saw the deed, and highly approved of it. Had the teacher prematurely taken a

part of the lunch from a pupil and given it to the one without, he would not have perceived the justice of such a proceeding, he would even have felt oppressed; and, so far from a strong impulse to generous action having been lodged in his breast, the selfish principle would have been stimulated by being thrown on the defensive. Where kindness is, a number of common school-faults are banished, such as rudeness of manner, calling names, and the like."

Honesty.—"Honesty, or a due regard to what belongs to another, is one of the virtues that must be implanted in the child from without, as there is no natural instinct which leads him to observe it. His desire of possessing is at first indiscriminate and unreasoning, so that it needs to be regulated with much prudence. It is not uncommon to prevail upon a child to restore what is not his own under promise of receiving something else. This is attempting to thrust out one vice by means of another. Neither will simple command or force, though perhaps a legitimate means of influence in the circumstances, inspire the right feeling, though it may put the property into the hands of its owner.

"Some children have a stronger tendency to dishonesty than others; and this is commonly found stronger in those who are subjected to bad influences at home. Sometimes it seems almost like an instinct in such children. Perhaps the best way to lead children to see the right way is to *seize the moment for inculcating truthfulness and honesty when the child has himself been the sufferer;* not when he has been the aggressor. Then he will feel the justice of your proceedings, and be in a mood to fully assent to them. He cannot say a word in self-palliation, should he afterward become the aggressor.

"The teacher should show a punctilious regard to the right of property himself. All things that are found must be scrupulously returned to their owners, for whom search should be made; so that importance shall be seen to be attached even to the smallest thing. Those who deliver up property which they find must be commended; those who are detected in concealing it should be disgraced."

Admirable examples may be witnessed in some of the public schools of New York City for teaching children to observe the *golden rule* in the matter of things found by the pupils. It is customary for the children to take whatever article is found, in or about the school, directly to the principal, who advertises it before the assembled school several mornings; then, if the owner does not claim it, the article is publicly presented to the pupil who found it. The frequent delivery of articles to the rightful owners, also of the return of others to the finder, have furnished numerous incidents of exceeding interest to the children, and of great satisfaction to teachers and parents. These practical moral lessons have a lasting influence.

"While right action is the natural result of right feeling, the habit of action has, no doubt, a reflex influence on the feelings. It is, on this account, well to encourage in the intercourse of children acts which are but bits of ceremony, as greeting each other with 'good-morning' on meeting, or bidding 'good-night' or 'good-bye' on separating, and of always thanking another for even the least favor.

"Love is the earliest emotion of which the child is conscious; love to its parents, who supply its wants. This emotion should be elevated by parents and teacher toward God, as our heavenly Father, the common source of all good to both parents and child. With love there should be inculcated reverence for God. This feeling may early be inspired in children, or rather drawn out of them, for it is natural to infancy. 'Thou, God, seest me,' finds a ready access to the child's heart. Reverence and love should grow up together."*

Habits.—"The sentiments which we desire to impress on the child must be cultivated till they pass into habits. In the power of habit lies the power of education. By means of habit alone

* For the principal statements under the head of "Means of Training the Feelings," in the preceding pages, credit is due chiefly to *Principles and Practice of Early School Education.*

we can fit any one for a sphere of life different from that which he occupies; and by the means of it we can fit him for any subsequent sphere of which the constitution of his being renders him capable. We can accustom him to any direction of activity, and mould his character and temper to any standard. It is in virtue of two features of this power of habit that we are entitled to look to the efforts of education as having a rational certainty of success. The one is the indefinitely great influence which this power may acquire, under the effectual agency of proper training. Strong as the instincts of our nature may be, we have in habit a weapon with which we may overpower any one of them; and that not by violence, but by quiet and almost imperceptible measures; hence the saying that 'habit is second nature.' The other is, that as we are born, not with formed habits, but only with the *capacity* of habit, it is left to us to begin our habits ourselves. Character, therefore, is within the power of those who control the years of infancy and childhood.

"The moral habits which education should foster are habits of *right action.* There is no test of virtue except its exhibition in action; we cannot otherwise be certain of its existence. A right feeling should have its issue in a corresponding action; but it depends altogether on education whether the natural connection be established between them. When feeling is cut off from action it is a mere sentiment. In the general case the feeling perishes in the sentiment; for the oftener we speak of right, as a matter of sentiment alone, the wider becomes the gap between the feeling and the act, and the weaker does the feeling become, as in the case of pity. There is no education to morality apart from the practice of morality. Children, who are ready to act in obedience to every impulse, should therefore see enacted before them the virtues they are to learn. Example is vastly stronger than precept. The society of which they are members should be so constituted and ruled as to give them the opportunity, as far as possible, of carrying out into action the good feelings to which they show a tendency. On the other hand, just as right feelings are strengthened by right acts, feelings of the lower sort must be weakened by removing all stimulants and opportunities to act.

"Habit is a power which cannot be left at our option to be called into existence or not; it is given us to use or abuse, but we cannot prevent its working. Children, with their infinitely varied impulses, and with all their experience to acquire, have an irresistible determination to activity. They cannot be subdued to quiescence and immobility, for we cannot suspend their natural growth, neither can we exclude them from forming habits of action. Whether we are conscious of it or not, we directly stimulate them to form certain habits, if we have intercourse with them at all; for they hear what we say, and they see what we do, and their imitation follows inevitably.

"The first moment at which there is capacity for action is the moment when we should begin the cultivation of habit; the child is then eager and pliant. With advancing years the disposition becomes more rigid, the sense of doubt and the anticipation of difficulties become stronger, and the whole force of habits which have been allowed to form themselves has to be encountered, so that the task becomes incalculably more arduous. Early habits are at once the most easily formed and the strongest. The habits which are acquired in mature years never attain the same stability as those formed in childhood.

"The influence of habit invests single actions with an importance far beyond what at first seems due to them. If we were at liberty to view actions by themselves, out of connection with the past and the future, many which require the gravest remonstrance would appear trifling and unworthy of serious notice. But the tendency to repetition is so strong, and in many circumstances so overpowering, that all who are charged with the education of youth fail in their duty, unless they are extremely vigilant in observing even the smallest exhibitions of moral activity. Hence it is that the *lie* in jest, the thoughtless waste of some little thing which seems of no further use, the unpunctuality of a minute, always demand attention, lest they become the threshold over which the child may pass to confirmed habits of untruthfulness, prodigality, or irregularity.

"The small and almost unobserved act of sympathy toward a neighbor or playmate, attention in removing a spot or other in-

jury from the dress or property of another, and the great care taken to be exact in punctuality, deserve a commendatory notice, for these may possibly be the turning-points in the child's character for benevolence, frugality, or regularity. We can never tell the effects of single actions; it is only prudent, therefore, to treat them as important. Everything should be encouraged of whose salutary tendency we are convinced; nothing should be permitted of whose evil tendency we have the slightest suspicion.

"We are not to expect great results in education in a short time; sudden leaps in character are not according to the law of our constitution, and are therefore to be suspected. Again, since the implanting of any habit is so great a work, we should not attempt to instil too many habits at once. If we have several in view to inculcate, let us first select one to establish the power of habit in general; when we have succeeded with that, we shall have given to the child a degree of self-control which will greatly facilitate his acquisition of the others. Again, there is but one way of correcting any bad habit which the child may have acquired, or of undoing any wrong association he may have formed. As it has not been formed in a day, so it is not to be overthrown in a day.

"But implanting of habits alone does not constitute training to morality. Habit, without intelligence and conscious motive, is the characteristic, not of a rational being, but of a machine. Acts performed under its influence have no moral character, whether their results are in accordance with morality or not. A habit of seeming morality cannot be permanent and sufficient as a moral power. The routine conduct to which it leads may go on for a while, as long as the child is kept out of circumstances which might interfere with his obedience to it; but it will never stand against the rush of personal prejudices and interests when these clamor for a hearing. There is wanted *intelligence* to give such acts a moral character that will remain secure against all opposing tendencies. Intelligence must be at hand to prevent 'good intentions' from leading us astray."*

* Extracts from *Principles and Practice of Common School Education*, by James Currie, A.M., Principal of the Church of Scotland Training College.

Means for Moral Culture.—Experience has shown that the true means for *moral culture* are the same in character as those for *physical* and *intellectual culture*, namely, *exercise*. But this exercise, to produce the desired results, and become of permanent benefit, must be had in conformity to correct principles, and be continued until *habits* are formed.

There is no good reason why one habit should not be established as easily as another. During childhood the season, the soil, the seed, and the implements are all in our hands, and we may choose what we will plant. Let, then, the companions, the precepts and examples, and all the surrounding influences, be such as shall furnish abundant *exercise* in truthfulness, justice, kindness, respectful obedience to parents, reverence and love for God, during the season of childhood, and habits of *right feeling* and *correct action* will be fixed that will gladden the hearts of parents, teachers, and friends with joyful anticipations.

Virtue can influence, as well as vice infect; but the influence of example in the practice of virtue is tenfold more powerful than good precepts alone. Therefore to teach truthfulness, honesty, kindness, or any other virtue successfully, the children must see these qualities practised in the daily conduct of those around them. The maxim that "like begets like" is nowhere so fully exemplified as it is in our moral natures. The exhibition of love, kindness, gentleness, benevolence, sincerity, and truth begets like virtues in others. *Children know but little of virtue in the abstract; they comprehend it as it is embodied in the actions of those around them.* Children who have never been deceived look upon promises as deeds, and a thread may lead them. Deceive them but once, and chains may be too weak to confine them.

"Thou, God, seest me," if properly remembered, will impart strength and activity to the conscience, and aid

in establishing habits of truthfulness, justice, purity of thought, humility, and kindness.

"Our Father who art in heaven" may be made the guiding sentiment in cultivating love, veneration, obedience, and hope.

"All things whatsoever ye would that men should do to you, do ye even so to them," is an injunction broad enough to furnish ample opportunities for the exercise of patience, kindness, and all the virtues which should govern our intercourse with each other.

Occasions for developing the moral natures of children, and means for exercises appropriate to this end, may be found in the occurrences of their daily lives. The familiar incidents so common to children furnish opportunities of the greatest value for their moral culture. Words alone cannot develop the physical powers, nor strengthen the intellectual faculties; neither will they produce moral character, nor develop those habits and virtues which contribute so largely to the happiness of ourselves and those around us. *Moral character does not consist in words or professions, but in actions.*

POWER OF WILLING.

THE WILL.

What the Will is.—The *will* is a power of the mind which is manifested through the acts of the mind. Every *choice* and every *rejection* is a manifestation of the *will*. The *will* is the power of the mind to direct its own actions. It is mind acting upon the powers of mind. It is a motive-force of the mind. Its seat appears to be with the *moral powers*, but its influence extends over the intellectual powers also. Its immediate incentives to action are the *desires*.

A Desire is an inclination of the mind for some object, or to do some act. It is a simple feeling which cannot be analyzed, although it is clearly known to our consciousness.

Willing cannot be defined; but that which takes place in the mind, immediately in connection with the act of willing, and within the range of our consciousness, may be described. *First*, the mind experiences, feels, or is influenced by *a desire* for some object, or to do some act, or to exercise some of its powers. *Then* the mind chooses, or *decides*, how it will act in relation to that desire. This constitutes *the process of willing*.

When *memory* is spoken of as a faculty or power of the mind, it is readily understood what is meant, for every one is conscious of the acts of memory. With equal propriety may the *will* be spoken of as a faculty or power

of the mind, yet what is meant by *will* may not be understood readily by every one, for its acts are not so clearly conscious to the minds of all as are those of memory. The powers of memory and will differ in their modes and spheres of manifesting themselves to our consciousness. Memory is the power of the mind for remembering. Will is the power of the mind for willing. Memory deals with ideas that come from things which are external to the mind. Will deals with the powers of the mind itself, directing their acts; and through them it controls the acts of the bodily organs. We are conscious of directing and fixing the attention upon any subject at our pleasure. That power of the mind which enables us to do this is the *will*. Care should be taken to guard against the impression that the will is some controlling agent separate from the mind, instead of a power of the mind itself.

"A lad whose education has been tolerably well conducted, whose trains of ideas have been formed in accordance with the realities of life, knows that he must be guided by knowledge, and that the produce of his labor must be husbanded with care and enjoyed with discretion. Sensible of all this, he *wills* to avail himself of the assistance of his instructor to acquire knowledge, and to form habits of application and self-restraint. And every successful effort of volition encourages him to persevere in the same track.

"In that complex state of feeling which gives rise to volition there is felt a desire to do what others are doing around us. The acts of others in whose society we habitually live seem to exercise a kind of contagious influence over our wills. We first *desire*, then *will* to imitate them. This tendency is peculiarly observable among the young. The old proverb, 'Evil communication corrupts good morals,' or its counterpart, which is much to be preferred, 'Good communications correct bad and confirm good morals,' seems to be partly founded on this oft-observed

tendency to imitation which prevails among mankind. It may be doubted, however, whether the potency of this readiness to imitate has been yet half acknowledged, or half turned to account in the grand business of education."*

Influence of Will on Character.—"The will is the immediate spring of all our actions. The understanding may perceive what our duty is; the feelings may present us with motives to do it; but it is this third power which determines whether it is to be done or not. We cannot wonder, then, that in the business of life it is commonly viewed as the most important of our faculties, as that, indeed, which gives its complexion to the whole character. 'Character,' it has been said, 'is a completely fashioned will.'"†

An aptitude for making a deliberate choice, and holding steadily to that choice, indicates strength of will. Constancy and perseverance indicate such strength. But obstinacy, or stubbornness of temper without reason, do not indicate this power. Obstinacy and stubbornness are perverted actions of the will. Powers of intellect may make a man an object of admiration, but without strength of will he can have but little influence over others. Even the accomplishments of education will become little else than so much ornamental fringe-work in life, without the influence of this power. A man's love of right and his desire to benefit society may not protect him from being made a dupe, or even being led to commit wrong acts, if his power of will is weak.

Will gives decision of character. It enables its possessor to achieve great results. It gives power over others, and thus makes a man great in the estimation of his fellows. Men are obeyed or resisted, respected or despised, in proportion to their power of will and the manner of exercising it.

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* *Outlines of the Formation of the Understanding*, by William Ellis, London.

† *Principles and Practices of Early School Education*, by James Currie, A.M.

Freedom of Will.—It is not intended here to enter into a discussion of this subject, about which so much has been said and so many volumes written. A few simple statements concerning the freedom of will must answer the requirements of the present work. The mind has freedom in observing, in remembering, in imagining, in comparing, and in reasoning. Each of these is an act of the mind. Willing is an act of the mind. The mind is free to observe, to remember, to imagine, to compare, and to reason; and it is equally free to will. No material restraint is laid upon it. No mental restraint is laid upon it. The mind itself is conscious, when it wills, that it exercises freedom. *Freedom of will, then, is the mind's power of willing freely.*

Training the Will.—We have seen that some desire always precedes the act of willing; also that man wills as he pleases—that is, as he desires. He chooses or rejects at pleasure. Why does the mind, in willing, follow one desire rather than another? Why does the mind sometimes will to do right, and at other times to do wrong? Proper exercise increases strength of the body, of the mind, and of its several powers. Remembering imparts strength to the memory; reasoning adds strength to the reason; *willing gives strength to the will; right willing develops good character.*

It is of the greatest importance that all who have anything to do with training the young should aim to so guide this power of the mind that it shall acquire *habits of right willing*, and thereby attain that strength of will which gives steadiness of purpose, and enables its possessor to choose carefully and hold firmly. The proper training of the will requires the most careful watchfulness on the part of parents and teacher. The foundation of right willing must be laid in early childhood.

The two most important defects to be overcome in training the will are *weakness* and *wilfulness.* The first is seen in lack of decision, irresolution, inconstancy, changeableness of mind, lack of a purpose. The second is a vice arising from lack of direction or from misdirection. *Wilfulness is a state of temper in which the will acts in obedience to the nearest motive, without regard to the character of the motive.* It implies strength of will, which, if rightly *directed*, would lead to a character of excellence and great influence. Children manifesting the first defect—*weakness*—need exercises to lead them to form habits of stronger wills; while those exhibiting the second defect require processes of training that will give them habits of controlling and properly directing their wills.

"The causes of these defects lie on the very surface of the children's daily life. Let a child be brought up so that by the over-watchful anxiety of its parents or guardians all its wants are anticipated, its gestures, and even its looks, scrutinized with the view of divining its desires, all situations in which it would feel the need of doing something for itself carefully excluded, and it will certainly follow that the nerves of exertion will be cut; indecision and helplessness will exhale from the stagnant waters; it will be miserable when alone, and show only a sort of insipid, meaningless satisfaction when it does receive attention. Such a child is destined to be trodden down or pushed aside in the race of life.

"Let a child be placed in circumstances where its nature is not understood or sympathized with, having none to appreciate its motives, to encourage it to exertion, to caution it when the tempter leads it astray, or to approve it when it has triumphed; let a harsh, unfeeling discipline drag it over the wilderness of fear, anxious only for submission, and the *will* will be crushed, the power and desire of activity will wither, while sullenness, gloom, dark suspicion, and cunning will supplant the nobler qualities of openness and decision.

"Let a child be brought up under no fixed discipline, its guardian not being aware of the importance of this, or not capable of carrying it out, or, perhaps, not being much with the child, thus ruling it only at intervals, while at other times it is left to itself, and the unsteadiness and violent contrast to which it is subjected must unsettle its dispositions; its own whims, or the suggestions of chance, will appear as binding on it as the commands it receives. Such a child will grow up unsubdued and unreasoning.

"Again, let the activity of a child be confined within the narrow groove of formality and routine; let it be surrounded by laws which prescribe for its conduct down to the minutest trifles; let directions be given whenever there is danger of its erring; let the smallest deviation from the accustomed path and pace call forth a senseless expression of affected wonder and dislike, and its *will* will be swamped. When it does right it is never from its own choice; it becomes timid and fearful of responsibility.

"Once more, let us put the case in which the affections of its guardians, exercised without prudence, systematically allow the child perfect freedom from restraint, letting it choose for itself before it has *light to guide its choice*, viewing its desires as law, or, perhaps, weakly purchasing ease by the gratification of them; this makes emphatically the *spoiled* or *wilful child.* The will is deliberately thrown, bound hand and foot, among its rebellious subjects—the passions—who strip it of its dignity, and reign in its place—a miserable anarchy. This child's path is being set with thorns. We see such pictures in the family circle; and it is certain that we often see them still more deeply colored in the school.

"The will acts in obedience to motives. The uneducated will obey those which are nearest at the time, though they may be the lowest of all motives—the animal propensities. *The object of moral education is to inspire the higher motives as an indwelling power, and to accustom the will to that suspense which is the first step toward obeying them.* By cultivating the moral feelings we are at the same time educating the will, inasmuch as we are providing right motives to influence it.

"Children will be occasionally rebellious, from their volatil-

ity; but obstinacy need not be feared, unless there be great mismanagement, for they cannot ultimately resist; and when they are made to do a thing over and over, they come to think it natural; moreover, it is an instinct in them to look up to their parents and guardians. If an obstinate child is introduced into school, it is not by any single stroke of energy that he is to be subdued: kindness and patience are the only means that will be completely successful.

"The authority of the teacher should not be founded on his personal superiority. The selfish tendency is strong in childhood, and will surely be incited to resistance; and, if we taunt a child afterward with his submission, we only harden him to disobey us at the next opportunity. The manifestation of strong passion, or bitterness of humor, tends to place authority on this insecure personal basis; whereas calmness with firmness tend to elevate it above all personal considerations."*

Will a Power in School Government.—*The secret of success in school government lies in the strength of will possessed by the teacher, and the power of leading the pupils to desire and to will to do those things which are right.* The means to be employed by the teacher for accomplishing this purpose should be of such a character as will ultimately lead the pupils to a *willing* obedience. The following incident will illustrate what means are appropriate for the attainment of this end:

A teacher was one day collecting the caps from a class of young children, to put them away in the closet where they were usually kept. One little fellow kept his cap back, and threw it at the teacher as she was going to put the others away. He was quietly ordered to pick up his cap, go to his seat again, and then deliver it in the right way. He took it from the floor and again threw it, but more gently than before. Again he was calmly ordered to pick it up and deliver it properly. This time, feeling

* *Principles and Practice of Early School Education*, by James Currie, A.M.

the power of the teacher's *will* through the calmly spoken words of firmness, he obeyed the command. Without exhibiting any temper or severity, the teacher made a few remarks *to the class* upon the importance of obedience, and the pleasure resulting from it. The next time that the pupils entered the school-room, and the teacher began to collect the caps, this boy was among the first to obey; and *so willing* was the obedience that he said to his teacher, "I have done right this time." Had anger or bitterness been exhibited by the teacher in this case, although obedience might have been forced, it would not have prepared the way for willing obedience in the future.

Authority, to be thoroughly established, so that it shall encompass the child beyond the teacher's personal presence, must be founded on kindness and justice, and then it will command respect. Its reality will be manifested in its own dignity and power. Its propriety will not need to be made a matter of demonstration. Its own utterances will be its sanction.

An authority which leans on anything else than its own expressions, that needs to have its supremacy proven, has no substance. The shadowy images of impending terror, the indefinite hints about something to come, the loud threatenings by which some seek to maintain their authority with children, are really signs of distress—signals by which those who are conscious that they do not possess the authority which they ought to have, proclaim their own weakness.

A proper training of the will requires that a just proportion should be maintained between obedience and freedom throughout the entire period of the educational course.

"He that has found a way to keep up a child's spirit—easy, active, and free—and yet at the same time to restrain him from

many things he has a mind to, and to draw him to things that are not easy to him—he, I say, that knows how to reconcile these seeming contradictions, has, in my opinion, got the true secret of education."*

"Direct authority is not a power to be exercised indiscriminately, but only where it is needed. It must supplement and strengthen motives, not supersede them."†

The perfection of discipline lies in adapting obedience and freedom to the several periods of the child's development. *Infancy is the period in which obedience should be learned. Before the child can choose what is good for him freedom is hurtful. Obedience is the first step in the child's education to freedom.* The sphere of the child's freedom is very narrow at first, embracing his animal or natural activity. It gradually widens as the child acquires habits of obedience and the ability to choose; and when he comes to be conscious of responsibility, he should be led to take responsibility, taking care that it be a fair responsibility to lay upon him, and one in which the consequences of a mistake would not be detrimental to his own moral character, or to the best interests of his associates. As soon as good motives are found to exist in the child's mind, we should allow him to be stimulated to action by them, while we keep our authority in the background.

"Whenever we can explain the reasons for any of our requests we should attempt it; but whenever these cannot be fully explained, it is better not to give a partial explanation; it will be best to say, steadily, 'You cannot understand this now; you will perhaps understand it some time hence.' Whenever we forbid children to do such and such things for any particular reason, we must take care that the reason assigned is adequate, and that it will hold good in all cases."‡

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* Locke. † James Currie.

‡ *Practical Education*, by Edgeworth.

One of the gravest errors in training the will, and in maintaining good discipline, lies in an attempt to exact the same kind of obedience, and to allow the same degree of freedom throughout all the periods of the child's development. The temptation for the teacher to disregard the change of circumstances on the part of the pupil is very strong, from the fact that it is easier, and with many more agreeable, to supersede the will for the time being than to train it in habits of right self-action. To inculcate an obedience that is free, and self-prompted, should be the aim of the instructor. This cannot be accomplished unless the child be given room for the judicious exercise of freedom. *To be always expressly commanding what the child may easily be led to do freely of his own desire, will never confer on him the inestimable blessing of a strong character.*

"Constancy of will is one of the last blessings which education has to bestow. It is one not to be reached till trials of all kinds have been endured—till the mind has power to reflect attentively on purposes deliberately formed, of which the realization lies yet in the remote future. It is but a short distance that the child, with his extreme volatility, can advance toward this goal, yet he may imbibe from the whole of his school-training, if it be judiciously conducted, an impression of constancy of purpose. He may feel himself enveloped by a power of which *constant, steady aim* is the mark; and thus he may receive a bent in this direction himself before he is at all conscious of the nature of the influence at work upon him. Thus a foundation is laid for constancy of purpose by the habit of perseverance which is formed, and this is a most auspicious starting-point for the will when it comes to a full degree of self-consciousness."*

Habits, to a great extent, constitute the character. They do not always have the sanction of the will; but,

* *Principles of Education,* by James Currie, A.M.

in effect, it is much the same as if they had. Habits become so strong that it is said they are a second nature. The formation of habits is the formation of character, and herein lies the influence of education to elevate the character. The teacher should remember the use of this power of habit in his work, and view all the acts of the child in the light of it.

"Things often seem trifling in themselves which are of great moment when viewed in this relation; for what we do once we are apt to do again, and we find it easier to do at each repetition. The child imitates itself even more readily than it imitates others. Single acts may seem of small consequence, but from their tendency to be repeated they are important. We can never estimate the effect of single acts; and this should teach us to permit nothing in children of the propriety of which we have the smallest doubt. Not only in moulding the child to a certain line of conduct, but in withdrawing him from a wrong one, habit is the only power available. One bad habit can be overthrown only by a good one growing up as a counter-agent; which, like its predecessor, must be formed gradually.

"There is, doubtless, one danger attending habit; it may degenerate into routine, thus subverting freedom. But we cannot help working by habit; we must form bad habits if we do not form good ones. In childhood habit is less mechanical in its nature than at a later period. The child's natural activity is so abundant that acting, though it be a repetition of the same thing again and again, is always fresh to him; so that during the period of early childhood there is nothing in habit which has a tendency to supersede will."*

* *Principles of Education*, by James Currie, A.M.

QUESTIONS

PERTAINING TO METHODS AND PRINCIPLES OF EDUCATION.

FOR THE EXAMINATION OF TEACHERS.

In presenting a series of questions for the examination of teachers, and candidates for teaching, the aim has been to give several questions relating nearly to the same points, on each subject, in order to furnish a suitable variety to meet the differing conditions, experience, and training of teachers, and also to enable those who conduct successive examinations on the same subject to vary the questions, and still be able to test the candidate's knowledge.

In using these questions it will be desirable, frequently, to change the phraseology of some of them, to adapt them to others selected on the same topic. In making a selection of a few questions from each subject, care should be taken that no two questions shall cover exactly the same points; also that the entire selection shall be sufficiently comprehensive to embrace the most important points in the topic under consideration.

SCIENCE AND PRINCIPLES OF EDUCATION.

METHODS AND ART OF TEACHING.

1. What is *education?*
2. What is the *science* of education?
3. What is a *principle* of education?
4. What is a *method* of teaching?
5. What is the *art* of teaching?
6. What is a *system* of education?

7. Describe a *method* of teaching—selecting your subject.
8. State differences between a *method* of teaching and a *principle* of education.
9. Mention three or more general principles that govern good methods of teaching.
10. What are the teacher's duties toward his pupils?
11. What is the work of the pupil in obtaining an education?
12. Should the pupil be chiefly a *receiver*, or a *doer*, in getting his education?
13. What do you understand by the term *development* in teaching?
14. Define the terms *teaching*, *training*, *learning*.
15. State the difference between *illustration* and *explanation*. Which should be most used in primary schools?
16. What is *rote-teaching?* Can it be made useful during any part of the process of instruction?
17. What is *cramming?* Why should it not be used in school work?
18. What should be the first step of the teacher toward instruction, on taking charge of new pupils?
19. With what must the work of instruction commence in any subject, to insure the best results?
20. What should education accomplish for the pupil?
21. Mention three points that a good method of teaching should possess; and state the special value of each.
22. Mention two or more prominent characteristics of children; and state how the instruction in a primary school can be adapted to those characteristics.
23. How can the natural activity of children be utilized in the methods of teaching?
24. By what means does the child gain knowledge of the world around him?
25. What are those organs called that enable him to get knowledge from external objects?
26. What powers of the mind are chiefly used by the child while gaining knowledge of things and actions?
27. What is the advantage of using more than one of the senses in gaining knowledge of the same object?
28. Which *sense* is occupied by the pupil during oral instruction?

29. Which sense is chiefly occupied by the pupil during illustrative teaching?

30. What *faculty* of the mind is most occupied in learning lessons from books?

31. What means may the teacher rely upon to develop and strengthen any power of the mind?

32. Should the acquisition of knowledge be made the chief aim in the work of teaching?

33. What should be the general character of the school exercises, for young pupils, during the first three years in school?

34. Mention common faults of teachers in questioning pupils. State important characteristics of good questions.

35. What is the chief result toward which the teacher's work should tend?

36. What particular results should the teacher aim to secure in the pupil's mental and moral training?

37. Should the pupil's ability to commit lessons to memory, and recite them readily, be considered a standard of his knowledge of the subject?

38. Mention the *mental powers*, or faculties, that are chiefly exercised by children under ten years of age.

39. State the *three periods of memory*, and the characteristics of each.

40. Mention studies that are adapted to each of the three periods of memory.

41. What constitutes a prominent difference in the ability of pupils to gain knowledge?

42. How may this difference be lessened by the teacher's work?

43. Do children generally *notice first the elements* or parts of an object, then observe the object as a whole? or do they *notice the object as a whole first*, and afterward observe its parts or elements?

44. What effect should the proper answer to this question have on the methods of teaching young children?

45. Should the teacher's chief aim be the communication of information to his pupils?

46. What is the first duty of the teacher when presenting a *new* subject to a class?

47. Why should the lessons for young children be short, and the subjects changed frequently?
48. Under what conditions may repetitions produce mental development, and aid in the acquisition of knowledge?
49. Mention the principal powers of the mind, and the office of each.
50. State a general principle by which any power of the mind may be strengthened.
51. Which powers of the mind are most active during childhood?
52. State the subjects of instruction which are best adapted to those faculties that are most active in childhood; and describe the general plan of teaching which is fitted to the condition of young pupils.
53. What is necessary to fitness for teaching?
54. State how the teacher should proceed in the work of education.
55. What part of a subject should be first taught, after the teacher has ascertained what the pupils already know relating to it?
56. Mention the general heads under which all human knowledge may be included.
57. What exercises will tend to make the sight more accurate in its perceptions?
58. By what means may the sense of hearing be rendered more acute in distinguishing sounds?
59. Should lessons that exercise the several senses and the perceptive faculties, or those which exercise reason and judgment, be chiefly used in primary schools?

[N.B.—For information that will supply answers to the foregoing questions, see previous pages in this book.]

READING.

1. When the young child first attends school, what does he know that may be used in teaching him the first lessons in *reading?*
2. Does he then know anything concerning *language?* If so, what is the known to him, in language?
3. Does he know words or sentences best? How does he know them—by the ear, as sounds, or by the eye, as forms? What is the unknown to be taught? Where and with what, then, should the teaching of language, or reading, begin?

4. Which should be taught first—words, sounds, or letters?

5. Would you use the blackboard, chart, or book first in teaching reading to young pupils? Why?

6. Mention important steps to be taken during the first month's instruction in reading, without the use of books.

7. State *methods* that you would use in teaching reading to beginners.

8. How would you prepare a class of children for the *first lesson* in a reading-book?

9. Mention the important steps, in their order, to be taken in teaching a class of beginners to read from books.

10. State the steps which should be taken with a class of young pupils, in teaching them to read a new lesson from the reading-book.

11. In beginning the use of reading-books in a class, what are the principal points to be attended to by the teacher?

12. Should reading generally be taught by directing the attention of the pupils to the thoughts represented in the lesson, and to a distinct and natural utterance of those thoughts, or chiefly by imitating the teacher's reading of the lesson?

13. While teaching a new lesson should the pupils attend to the meaning of single words chiefly, or to groups of words as used in phrases? Why?

14. Should pupils be allowed to read words singly, or required to read them in groups? Why?

15. Should instruction in the meaning of phrases used in the lesson, or the definitions of words receive more attention? Why?

16. What are the prominent characteristics of excellent reading?

17. Should instruction in reading, during school, be confined to the usual class reading-books?

18. Can reading in concert be employed so that the evil habits acquired by it shall not overcome all the good results that may be attained by it?

19. Write a brief outline of a good course of instruction for teaching *reading*—an elementary course, and an advanced course. State the principal ends to be attained in each course.

20. Mention three important points in teaching reading, in their order. State why each point is important.

SPELLING.

21. Should reading be taught by means of and through spelling; or spelling be taught by means of and through reading?
22. Should the spelling of words be taught before their use and meaning are understood?
23. Should reading or spelling receive more attention in a primary school?
24. For what purposes should spelling be taught?
25. How can spelling be taught so as to secure the object of teaching it?

PHONETICS.

26. What benefit do pupils derive from phonetics?
27. Mention the chief uses of phonetics in school.
28. What are the uses of a knowledge of elementary sounds in teaching reading?
29. How should instruction in phonetics be given?
30. Indicate sounds, and the *silent* letters in the following words: *knife*, *what*, *school*, *though*, *cough*, *bough*, *chin*, *box*, *sew*, *knead*, *exquisite*, *does*, *said*, *four*, *sure*, *was*, *they*, *word*, *thing*, *height*.

[N. B.—For information relating to teaching reading, phonetics, etc., see *Primary Object Lessons*, 40th Edition.]

OBJECT-TEACHING.

1. What is *object-teaching?*
2. What is an object lesson?
3. What is the *design* of object-teaching?
4. State what children first notice in relation to objects. Should all lessons on objects be begun in the same manner?
5. State some of the uses of object lessons.
6. Mention the important steps in an object lesson.
7. Write a brief sketch of an object lesson, showing what should appear on the blackboard when the lesson is finished.
8. What is the proper range of object lessons?

FORM.

9. What would you give as the first lesson in *form?*

10. Compare two of the following solids, and state their *resemblances* and *differences*—cube, pyramid, cone, cylinder.

11. Mention the two most important conditions, relating to *parallel lines*, that pupils should notice in order to understand the term.

12. State the most prominent facts to be observed as to the shape of *pyramids.*

13. Mention some of the advantages which children derive from lessons on *form.*

14. What facts would you teach young pupils relating to the shape of a *cube?*

COLOR.

16. Mention important uses of lessons on *color.*

17. What exercises should constitute the chief lessons on color?

18. Why do not all children distinguish colors?

19. What should the teacher endeavor to ascertain relative to color, concerning each pupil? Why?

20. How may tests be made for *color-blindness?*

21. What do you understand by *harmony of colors?*

22. Mention uses of learning to distinguish harmony in colors.

23. Mention colors used for *signals*, and what each indicates.

QUALITIES.

24. Mention some of the uses of lessons on *qualities.*

25. State the important steps in a lesson on a quality.

26. How would you proceed in teaching a lesson on *elasticity?*

27. Should lessons on *single qualities*, illustrated by several objects, or lessons on the *several qualities* in the same object, be given first? Why?

28. How would you illustrate to a class the differences between *flexible* and *elastic; compressible* and *malleable; soluble* and *fusible?*

29. Which are most appropriate for young pupils, lessons on different qualities in the same object, or lessons on a single quality with various objects?

ANIMALS AND PLANTS.

30. State why lessons on *animals* are useful for object-teaching.
31. Mention animals and their characteristics that may be observed by children during their first year in school.
32. State the kind of lessons on animals that are appropriate for the older pupils in a primary school.
33. Should such attention be given to lessons on single animals as will prepare for subsequent lessons on their classification?
34. Mention some of the uses of lessons on plants, for young pupils.
35. State some of the important features of lessons on plants, as a means of developing habits of observation.
36. What is the general character of the instruction relative to plants which is suitable for primary pupils?
37. Write a brief outline of a course of instruction for object lessons on one of the following topics: *form*, *color*, *qualities*, *animals*, *plants*, *objects*.

[N.B.—For information relating to object-teaching, and methods for teaching different topics, see previous pages in this book; also *Primary Object Lessons.*]

NUMBER AND ARITHMETIC.

1. What should constitute the first lessons in *number?*
2. On what must the child's knowledge of *arithmetic* be based?
3. State the three steps necessary to complete the process of instruction in each subject in arithmetic.
4. State a method for teaching pupils to *add* readily and accurately, without counting.
5. Give examples of a good method for teaching the following rules: *addition*, *subtraction*, *multiplication*, *division.*
6. How should lessons on the *tables of weights and measures* be introduced to a class?
7. What are the principal steps in teaching *notation* and *numeration?*
8. In oral arithmetic, what points should be kept in view in deciding what forms of solution are best for young children?
9. Into how many steps, or difficulties, would you divide the work of teaching *division?*

10. What should constitute the lessons in *arithmetic* during the child's first year in school? What during the second and third years?

11. What general plans would you pursue in teaching the tables of weights and measures?

12. State the difficulties to be explained in teaching multiplication.

13. Write a brief outline of a good course of instruction for teaching *arithmetic*—give three or more steps for the elementary course, and three for the advanced course. State the principal ends to be attained in each step of the course.

[N.B.—See *Primary Object Lessons.*]

GEOGRAPHY.

1. With what should the lessons introductory to *geography* begin?
2. What should constitute the first lessons in geography?
3. State a general plan for giving early lessons in geography.
4. How would you give the child ideas of the world, its shape and size?
5. What is the natural starting-place for teaching geography?
6. What should be the general character of the instruction in geography in primary schools?
7. What classes of facts do you consider most useful for advanced pupils in geography?
8. Write a brief outline of a good course of instruction for teaching geography—including the introductory steps.

[N.B.—See previous pages in this book.]

SCHOOL MANAGEMENT.

1. What qualities, in the teacher, are conducive to success in school government?
2. What should the teacher endeavor first to ascertain, in relation to his pupils, as necessary to success in the management of his school?
3. By what means should the discipline of a school be secured?

4. How may the processes of instruction be made to aid in the discipline of a class?

5. What means may be used for elevating the general character of a class, in respect to good conduct?

6. How may pupils be trained to habits of orderly behavior, and prompt and willing obedience?

7. When is praise proper, as an aid to school management?

8. What is the general effect of *scolding*, *fault-finding*, and *censure* upon pupils?

9. State how *encouragement* may be made effective in the management of pupils.

10. What is the effect of frequently telling children of their faults, before the class?

11. Should the teacher's chief aim, in the discipline of his class, be to correct individual faults, or to overcome them by developing the public opinion of his class in favor of the right, and to dislike the wrong?

12. Should the formation of good habits, as to character or the acquisition of knowledge, constitute the chief aim in school discipline?

13. What constitutes good order in a school? State some methods by which it may be maintained.

14. State important matters to be attended to in the organization of a school; why each matter is important; also what means are adapted to secure the best results in school organization.

15. What should the teacher do when the pupils cease to give proper attention to the lesson?

16. Mention some of the means that are appropriate for securing the attention of pupils.

17. State general plans of discipline that are successful in the management of school.

18. What means would you employ for maintaining order in your class?

[N.B.—See previous pages in this book.]

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THE END.

CALKINS'S PRIMARY OBJECT LESSONS.

PRIMARY OBJECT LESSONS, FOR TRAINING THE SENSES AND DEVELOPING THE FACULTIES OF CHILDREN. A Manual of Elementary Instruction for Parents and Teachers. By N. A. CALKINS. Fifteenth Edition. Re-written and Enlarged. 12mo, Cloth, $1 00.

"Instruction must begin with actual inspection, not with verbal descriptions of things. From such inspection it is that certain knowledge comes. What is actually seen remains faster in the memory than description or enumeration a hundred times as often repeated." Thus wrote John Amos Comenius, an exiled teacher of Austria, about the middle of the seventeenth century. And to the introduction of his works Germany is largely indebted for the great progress in her schools which commenced during that century. Said the great Swiss educator, Pestalozzi, at the close of the eighteenth century, "Observation is the absolute basis of all knowledge. The first object, then, in education must be to lead a child to observe with accuracy; the second, to express with correctness the result of his observations." On the philosophical principles taught by those two great educators, and confirmed by the experiences of subsequent observers, is based the system of mental development illustrated in the present work.

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